

CONTRACTORREPORT

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Weeks Island Strategic Petroleum Reserve Geological Site Characterization Report

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GLOSSARY OF ABBREVIATIONS

Acres	Acres International Corporation
DOE	U.S. Department of Energy
GAO	Government Accounting Office
Gulf	Gulf Interstate Engineering Company
Morton	Morton Thiokol, Inc.
MSHA	Mine Safety and Health Administration
SNL	Sandia National Laboratories
SPR	Strategic Petroleum Reserve

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1 - SUMMARY

This detailed geologic site characterization of the Weeks Island salt dome in Louisiana was carried out by Acres International Corporation (Acres) under contract 01-9182 with Sandia National Laboratories (SNL). Acres was supported throughout this study by Dr. Thomas Magorian, Consulting Geologist and Geophysicist, who was engaged under a separate contract with SNL. The Weeks Island dome includes the Department of Energy's Weeks Island Strategic Petroleum Reserve (SPR) crude oil storage site.

The three principal areas covered by this study were:

- Stratigraphy and lithology of the sediments adjacent to the dome;
- Structure within the sediments adjacent to the dome; and
- Geometry and structure of the salt dome.

Several geologic, geotechnical, and hydrologic studies have been performed at the Weeks Island SPR site since 1977. The majority of these studies were directed at certifying the mined facilities for oil storage and/or assessing potential **geotechnical** hazards which could adversely affect oil withdrawal and containment. The data generated from these previous studies have, where appropriate, been incorporated into this report.

The stratigraphy overlying the salt at the Weeks Island dome is a series of Recent to Pleistocene sands and gravels with **dis-**continuous lenses of clays and silts. The ground water regime in these sediments is a single aquifer whose piezometric level corresponds with sea level. The permeability of the soils over

the dome is generally high, on the order of 1.0×10^{-2} **cm/sec**. Ground water recharge is from surface water percolating downward through the permeable sands and gravels. Salinity within the aquifer increases with depth becoming very nearly saturated approximately 12 feet above the salt dome.

The stratigraphy around the dome has been defined on the basis of data from over 400 oil and gas wells drilled around the perimeter of the dome. A computer program was developed for this study which allowed for input of structure and stratigraphy from the geophysical well logs. From these data, a series of structure, contour, and profile maps were generated on and around the dome. A total of three major faults and one minor fault were mapped in the surrounding sediments. These faults all intersect the dome and, for the most part, are associated with the upward emplacement of the dome with time. The largest fault intersects the NW and SE quadrants of the dome. This fault, which strikes approximately **N45W**, is part of a major Gulf Coast growth fault which has been mapped throughout the Five Island Salt Dome Chain and may have been a contributing structure in the upward growth of the Weeks Island dome.

Weeks Island presented the unique opportunity to relate in-mine geologic structures with those mapped within the sediments around the dome. Although interpretative, there appears to be direct correlation between two of the external faults and sheared and disturbed zones mapped within the dome.

Top-of-salt elevation was defined from more than 100 borings that have been drilled over the top of the dome. This greatly expanded data base allowed for a new interpretation of the salt contours. However, over some areas of the dome, **particular**y in the north and northeast, there is insufficient control to accurately define top-of-salt.

It has been calculated that the upward growth of the dome has been approximately 0.1 in/year (2.5 mm/year). Off setting this growth is the apparent subsidence over the dome resulting from convergence of the various mine workings with time. Preliminary measurements indicate that as much as 0.8 feet of surface subsidence may have occurred over the SPR facilities since 1983. Further detailed subsidence monitoring is planned for implementation in 1987-88.

A detailed review and summary of previous studies relative to salt composition and mine stability were performed. In **summary**, the results of Acres 1977 and 1979 reports confirmed the overall long-term stability and containment of the SPR facility.

2 - INTRODUCTION

2.1 - Scope and Objective

Sandia National Laboratories (SNL) is responsible for the **geo-**technical program for the Department of Energy's Strategic Petroleum Reserve (SPR). The overall scope of the program includes all of the geotechnical investigations necessary to support the SPR program. Site-specific efforts have been directed in five areas:

- (a) Site characterization;
- (b) Engineering design assistance and evaluation (including numerical simulation models);
- (c) Laboratory and bench scale testing of salt and other materials from the SPR sites;
- (d) Instrumentation development and evaluation; and
- (e) Monitoring and interpretation of field events.

This report has been prepared as a comprehensive geological site characterization program for the Weeks Island SPR site by Acres under SNL contract Document **01-9182**. Acres was assisted by Dr. Thomas Magorian, Consulting Geologist and Geophysicist under separate contract to SNL.

The three principal areas covered by this report are:

- (a) Stratigraphy and lithology of the sediments adjacent to the dome;

- (b) Structure within the sediments adjacent to the dome; and
- (c) Geometry and structure of the salt dome.

The objective of this study is to provide a thorough geological characterization and identify any structures which could adversely affect mining or storage operations of the facility. This characterization only addresses the **geologic/geotechnical** aspects of the Weeks Island facility and does not take into account other technical or non-technical DOE activities such as operations and surface facilities which could adversely impact the facility.

A number of previous reports have been prepared on the Weeks Island facility during the course of the SPR program. A summary of those previous reports is presented in Section 2.3 of this report. Information developed as part of those previous studies that is relevant to the geologic characterization of Weeks Island has been utilized and reproduced as appropriate in this report.

This report is presented in seven sections. The remainder of this section presents a summary of the previous studies on the site; Section 3 provides a summary of the historical activity at the Weeks Island dome; Section 4 discusses the surface and near-surface geology; Section 5 presents the stratigraphy and structure in and around the dome; and Section 6 contains a discussion on the mine stability and the geotechnical impact of the findings on the SPR. Section 7 addresses the potential impact of natural hazards on the SPR facilities.

2.2 - Location and Arrangement of the Weeks Island SPR

The Weeks Island SPR site is located on the Gulf Coast south of New Iberia, Louisiana, and is one of the Five Island salt domes in central Louisiana (Figure 2.1). The "island" rises some 170 feet above the surrounding marsh and swamp (Figure 2.2). The Weeks Island salt stock is approximately 2 miles in diameter at a depth of 800 feet and the top of the salt ranges between approximately 40 and 90 feet below ground level.

The arrangement of the facilities within the dome and the DOE property boundaries are indicated in plan on Figure 2.3. Details of the historical development of these facilities are given in Section 3 of this report.

The SPR facility at Weeks Island consists of two abandoned Morton Salt Company mines which have been converted to the storage of oil. These mines are commonly referred to as the upper and lower mines or the upper and lower levels. These mines were served by two shafts, a **9-foot** diameter Service Shaft and an 18-foot diameter Production Shaft. When it was decided to convert the two levels to oil storage, a new mine was developed by Morton Thiokol, Inc. (Morton) to the west of the old, upper level mine to continue salt production. This mine is known as the Markel Mine. During the development of this mine, one access drift encountered water inflows and was abandoned and bulkheaded. This drift is now commonly referred to as the "**wet** drift" (Figure 3.4). Other drifts were successfully completed to reach the site of the Markel Mine without encountering further water inflow.

Use of the two existing shafts continued while two new shafts were sunk by Morton. When the upper and lower mines were converted for **SPR** storage, the old Service Shaft was used as the oil withdrawal shaft, and enlarged just above the upper level

for the manifold room. Mining continued in the Markel Mine until the new shafts were completed, when mining commenced in a mine beneath the Markel Mine. This mine is currently in **operation** and is referred to as the New Morton Mine.

2.3 - Previous Geotechnical Work

(a) Acres American Incorporated 1977 and 1979 Studies

In 1977, Acres was contracted by Gulf Interstate Engineering Company to:

- Investigate and describe the geotechnical conditions at the Weeks Island salt mine and thereby confirm its suitability for crude oil storage over a period of 40 to 50 years;
- Determine any limitations on the operating methods imposed by these conditions.
- Estimate the work involved in converting the mine for oil storage;
- Determine the safe web thickness required between the existing mine when filled with oil and any new mining operations below, and hence, determine the technical feasibility of developing such a new mine; and
- Develop schemes for the long-term monitoring of the existing mine and any new mine during operation of the crude oil storage.

Work carried out in the 1977 study to meet these objectives included geological mapping and inspection of the mine, core drilling, in situ testing, laboratory testing of samples recovered from the mine, analysis of the structure of the mine, and associated office studies. As a result of these studies, the following conclusions were presented in the final report [Acres (1977)]:

- The existing salt mine was certified as suitable for long-term storage of crude oil. Stability and containment potential for both levels of the mine and both shafts were confirmed.
- The salt mass, for all intents and purposes, was impermeable.
- A significant characteristic of the salt mines are "blowouts" which may occur at the time of blasting.
- The cause and mechanism for blowouts was unknown.
- Blowouts did not adversely affect the stability and containment function of the mine.
- Weeks Island salt is inert to crude oil; long-term storage of oil will not lead to any adverse reactivity.
- Neglecting the possibility of blowouts, a minimum web thickness of 300 feet should be provided to ensure the safety of mining operations below the oil storage facility.

In 1979, additional work was undertaken by Acres at the Weeks Island SPR facility under subcontract to Ralph M. Parsons Company to satisfy various questions raised by the Government Accounting Office review of the project (Comptroller, 1978). This work was to:

- Perform drilling and testing in the upper level of the mine on a scale similar to that previously carried out in the lower level.
- Drill and test at the highest practical level in the bypass ventilation drift near the Service Shaft to further investigate any variations in properties of the salt with depth from the top of the dome; in particular, the permeability of the salt mass to vapors.
- Make general assessment of the effect of all mining work carried out since the 1977 studies.
- Investigate the effectiveness of the bitumen seals in the shaft lining and determine the loading capacity of the concrete lining.

The conclusions of that study [Acres (1979)] were that:

- There is no significant variation in the salt characteristics between the upper and lower levels.
- The long-term stability and oil containment of the upper level is assured.

- The stability and containment of both levels have not been adversely affected by mining and tunneling within the dome since 1977.
- The salt in the vicinity of the bulkheads isolating the storage areas is sound with no evidence of any structural deficiencies or porous zones in the critical areas.
- Permeability of the salt mass is so low that no leakage of hydrocarbon vapors or other gasses through the salt is anticipated.
- There is no apparent change in condition of the Service Shaft since the 1977 inspection.
- There is potential for serious damage to the oil recovery equipment in the manifold room and Service Shaft due to flooding from the mining operation or failure of the Service Shaft.

(b) Sandia National Laboratories 1980 Study

As part of **SNL's** geotechnical support, a site characterization, summarizing previous DOE work, was performed (Sandia, 1980) which consisted of:

- Compilation, evaluation and interpretation of the existing data pertinent to the geologic characterization of the SPR site.

- Characterization of surface and near-surface geology and hydrology with respect to its impact on SPR surface facilities.
- Definition of the geometry and geology of the salt dome.
- Assessment of the possible effects of natural events,
- Assistance in the planning and development of a **long-term** monitoring plan to ensure the integrity of the facility.

No additional field investigations were undertaken for this study.

(c) Sandia National Laboratories 1985 Study

In 1984-85, SNL, in association with Acres, undertook a study to qualitatively and quantitatively identify potential geotechnical risks, including water leaks, to the underground oil storage facilities at Weeks Island and to recommend remedial methods to either minimize or eliminate the risks (Sandia, 1985). As described in detail in Section 3.1, water was encountered in the salt while driving a drift to the new Markel Mine (Figure 3.4) in 1977-78. This was later sealed and became known as the "**wet** drift".

Concern was raised as to the source of water which was encountered and its potential impact on mining and SPR facilities in the dome. In addition to this concern, risks were also evaluated for the Production and Service

Shafts, the Markel Mine and associated drifts, and the vent and fill holes. Each area was addressed by:

- Assessing existing potential problems;
- Developing future scenarios;
- Evaluating inspection and monitoring programs to predict problems;
- Estimating costs of alternatives; and
- Performing static risk assessments for the failure scenarios.

In addition to these activities, a dynamic risk assessment of the "wet drift" was performed to evaluate the potential risk it might pose with time.

(d) Sandia National Laboratories 1986 Study

One of the risk scenarios developed as part of the "Results of a Geotechnical Risk Assessment of the SPR Facility at Weeks Island, Louisiana", involved shaft leakage which could lead to loss of the shafts and ultimately, jeopardize the containment of the crude oil (Sandia, 1985). Because of the general lack of data regarding the conditions around the shafts, Acres was retained to undertake additional geotechnical studies to define the stratigraphy and ground water regime in proximity to the shafts and overlying the salt at the Weeks Island dome (Acres, 1986).

(e) Miscellaneous Investigations and Studies

Over the last 10 years, there have been a number of special geologic and geotechnical investigations and studies undertaken relative to the Weeks Island storage

site. Many of these are ongoing activities at the time of this report preparation and include:

- Leak testing of the wet drift bulkhead;
- Service Shaft and Production Shaft investigation and grout testing;
- Bulkheads leak detection;
- Surface subsidence and mine convergence measurements;
- Water entry detection and measurement;
- Subsidence predictive modelling; and
- Markel Mine inspection reports.

An annotated bibliography for the Weeks Island dome is given in Appendix A.

2.4 - Approach to Study

The geologic characterization of the Weeks Island dome has been based on data gathered from:

- Geophysical well logs from deep oil and gas wells drilled around the dome (Tables C.2 and C.3);
- Interpretations of drillers' logs for shallow borings drilled to the top of the salt (Tables C.4 and C.5);
- Mine and surface mapping; and
- Review of previous reports (Appendix A).

Many of these data were a result of the previous studies undertaken by the DOE and/or Morton. The logs of wells located on and around the dome were collected, cataloged, and indexed, and

are presented in Appendix C. Stratigraphic contacts and structures were identified from the various well logs and input into a computer data base (Appendix B). Information obtained from these sources was then used to define the boundaries of the salt dome; the stratigraphy and structure around the dome; and the structure within the dome.

Boundaries of the salt dome were defined using information from approximately 100 borings which penetrated the salt, together with limited proprietary surface seismic reflection data. In addition, the methods of sediment convergence and salt-edge tectonics were used to define the geometry of the salt dome. These methods are based on the assumption that the shape of the dome can be determined from the properties of the surrounding sediments and their deformational characteristics. It is well known that the dip of shale and sand units adjacent to a dome tend to deform upwards along the edge of the dome as a result of the piercement intrusion of the salt stock through the sediments. By projecting the increasing dip of two or more stratigraphic contacts towards the salt, a point where the stratigraphic unit intersects the salt can be plotted on a geologic section. This geometric relationship allows for a relatively accurate prediction of the location of the **salt-edge**. Stratigraphy and structure maps around the dome were developed from interpretation of the geophysical well logs.

To assist in the geologic interpretation, a set of computer programs were developed as part of this study. The programs utilize the available subsurface data to present cross sections and structural maps. Specific details of the computer programs are presented in Appendix B.

Structures within the dome were interpreted from the surrounding sedimentary structure, geophysical data, and information available from mine and surface mapping.



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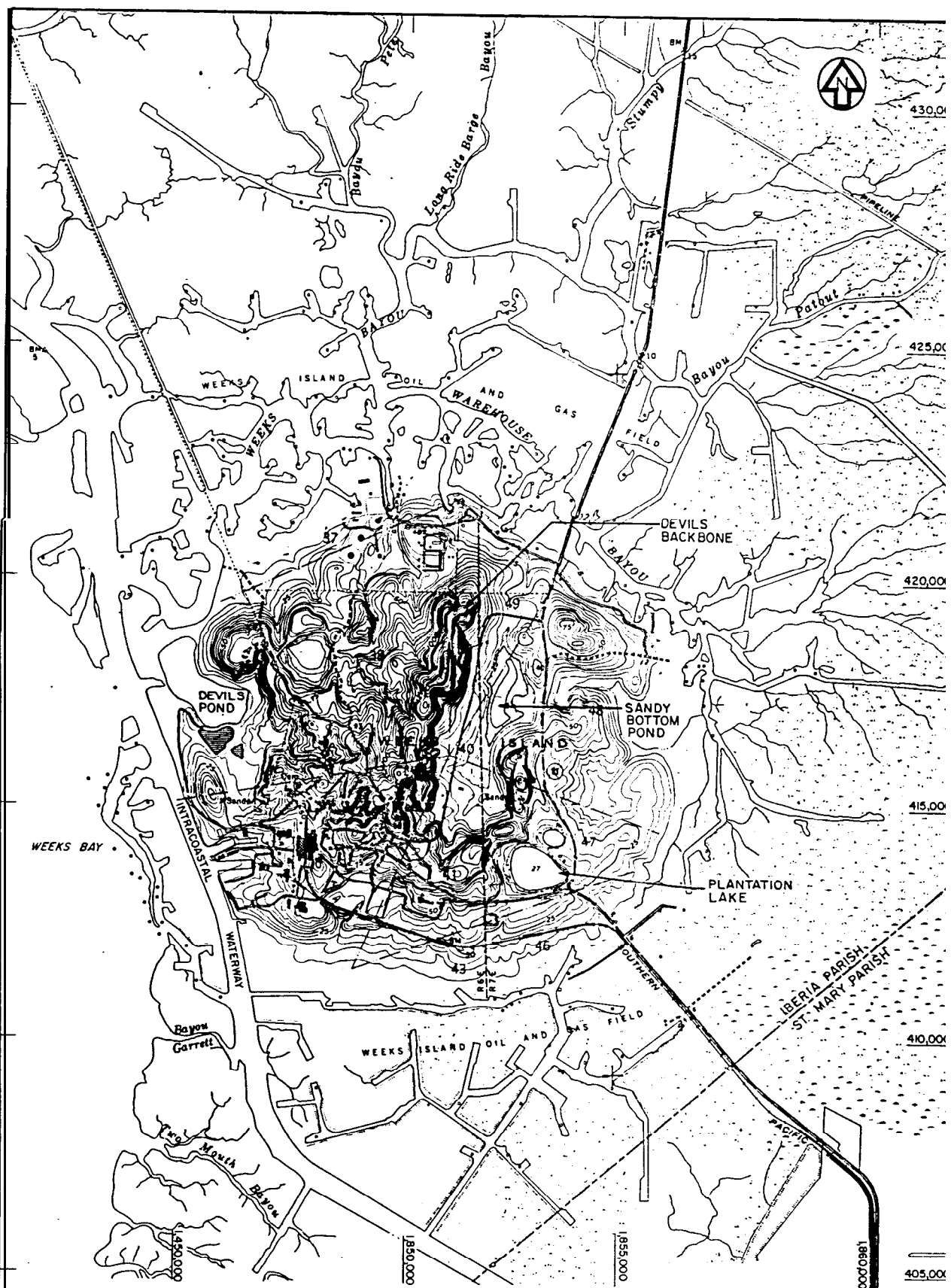
WEEKS ISLAND SPR SITE

SITE LOCATION MAP

MAY 1987

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 2. I



NOTES:

1. TAKEN FROM 1963 USGS SURVEY. PHOTO-REVISED 1960.
2. COORDINATES SHOWN REFER TO LOUISIANA COORDINATE SYSTEM (FT.)

SCALE 0 2000 4000 FEET

ACRES SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

SITE TOPOGRAPHIC MAP

ACRES INTERNATIONAL CORPORATION
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FIGURE 2.2
MAY 1987

FIGURE 2.2



420.000

MORTON MINE
TEL. -12001
FEB. 1967

MARKEL MINE
(EL. -530)

MORTON SERVICE
SHAFT

MORTON PRODUCTION
SHAFT

DOE SERVICE
SHAFT

MARKEL INCLINE

DOE PRODUCTION
SHAFT

PUMPHOUSE 1

BRINE
CAVERN #1

BRINE
CAVERN #2

DOE PROPERTY BOUNDARY
FROM EL. -61 FT. TO EL. -1035 FT.

DOE PROPERTY BOUNDARY
FROM EL. -1035 FT. TO EL. -1385 FT.

LAYDOWN YARD

UPPER MINE LEVEL
(EL. -535)

LOWER MINE LEVEL
(EL. -735)

WEEKS 2

FLARE STACK

FILL HOLES

STATE ROUTE 83

115.000

845.000

850.000

855.000

SCALE 0 1000 2000 FEET



SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

PLAN OF UNDERGROUND
WORKINGS

ACRES INTERNATIONAL CORPORATION
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FIGURE 2.3

MAY 1987

3 - HISTORICAL ACTIVITIES

3.1 - Conventional Mining Activities

After discovery of salt at Weeks Island in 1897, a **9-foot** diameter shaft was sunk in 1898-1902, now identified as the Service Shaft, and salt production commenced at the 535-foot level in 1902. The shaft was lined with cast iron segments bolted together and an inner cement mortar lining was poured against the cast iron. Asphalt seals were placed between the top-of-salt and the bottom of the cement liner to prevent water leakage behind the liner (Figures 3.1 and 3.3). The mortar was covered with a further timber (cedar) lining which was removed in 1986. This composite lining extends approximately 50 feet into salt to a depth of 150 feet below ground surface (Figure 3.1). In **1986/1987**, a detailed investigation was carried out by the DOE to accurately define the properties and conditions of the Service Shaft. Results of that investigation are shown on Figures 3.2 and 3.3, with coring details presented on Table 3.1.

Mining continued in the 535-foot level, now referred to as the upper level, until the mid-1950s using the room and pillar technique. The layout of this level, although highly irregular in areas, is typically **100-foot** square pillars with rooms 50 feet or more wide. The rooms are approximately 75 feet high (Acres, 1977). The upper level, which covers an area of about 100 acres, was abandoned in 1955 for economic reasons related to the excavation and haulage techniques employed at the time.

In the **mid-1950s**, the Service Shaft was deepened, and a new shaft (the Production Shaft) was sunk to a depth of 804 feet, enabling a new mine to be developed at a depth of 735 feet below sea level. The new shaft was 18 feet in diameter and was

concrete lined 110 feet into salt to a total depth of 271 feet below ground surface. The lower level pillars were laid out directly under the upper level pillars to provide increased stability. Room and pillar dimensions were approximately the same as the upper level (Acres, 1977). The lower level consisted of 50-70 foot rooms with **100-foot** square pillars. Final room height was on the order of 75 feet. The lower level covered an area of approximately 195 acres.

In 1976, the Federal Energy Administration (currently DOE) acquired the Weeks Island mine from the Morton Salt Company (Morton) for the SPR program. The 1976 purchase agreement between the DOE and Morton allowed Morton to continue utilizing the existing mine shafts, utilities, hoists, and ventilation while developing and working on the Markel Mine to the northwest of the existing mine at an approximate depth of 530 feet (see Figure 2.3).

During mine conversion activities, a drift known as the Markel Incline was driven from the lower level upwards at approximately a 12 percent slope to a high point at elevation -370 feet, and a series of high level drifts were excavated to provide access between the Production Shaft and Service Shaft (Figure 3.4). In 1977, while advancing from the high level drifts down to the Markel Mine area, a zone of wet salt was encountered during routine drilling and blasting. Minor water inflows occurred and excavation was stopped in late 1977. The water leakage increased to about 50 gallons per hour (gph) in mid-December 1977. Attempts to seal off the seepage by grouting operations performed from within the drift and from the ground surface in January 1978 substantially reduced the leakage. Water analyses and dye tests indicated that the water was meteoric in nature. Test borings by Morton indicated a significant zone of wet salt existed around the "wet drift". As a

result, it was decided to isolate the "**wet** drift" by the construction of a 35-foot thick bulkhead and to excavate new access tunnels to the Markel level. The intent was that if uncontrolled inflows were to occur, the bulkhead could be sealed and the drift allowed to fill with water without affecting other areas of the mine or storage facilities. Two alternate inclines (Figure 3.4) were subsequently excavated around this drift to the Markel Mine without encountering any major seepage.

In late 1978, the leakage rate in the abandoned "**wet** drift" suddenly increased to nearly 200 gph and further grouting operations were undertaken within and adjacent to the drift through April 1979. Since that time, remedial grouting has been routinely carried out in the "**wet** drift" whenever leakage rates significantly increased. A monitoring program of leakage into the drift is being maintained.

The Markel Mine was mined by the room and pillar method with 75 foot high, 90-100 foot room sizes. The Markel Mine was mined by Morton through 1981 until two new shafts had been sunk (Shaft Nos. 3 and 4) and a new mine developed at approximately the **1200-foot** level in the northwest section of the dome beneath the Markel Mine. Mining in this new Morton Salt mine has continued to present, with mining currently proceeding in a northerly direction. Mining of the New Morton Mine has been by the conventional room and pillar method. Although somewhat varied, pillars are approximately 100 feet by 100 feet with a maximum height of 75 feet.

3.2 - Mine Conversion

As Morton continued the mining of the Markel Mine, the DOE undertook the conversion of the Weeks Island mine for oil storage. This conversion included:

- "High Level Drifts" development;
- Scaling and stabilizing rooms and pillars in the mine;
- Construction of an oil sump;
- Development of an in-mine drain system to allow oil flow into the sump;
- Drilling of drain holes **between** mine levels;
- Construction of a manifold room in the Service Shaft and installation of pumps and piping;
- Drilling and construction of two fill holes and a vent hole from the surface;
- Construction of bulkheads in the Service and Production Shafts, Markel Incline, two 6-foot diameter raisebores, and an 11-inch diameter utility hole; and
- Construction of associated surface facilities to include oil distribution and control systems.

3.3 - Solution Mining

Two brine wells operated by Morton are located approximately 1500 feet northeast of the SPR mine (see Figures 2.3, 5.1 and 5.14). Although very little history of these wells could be found, records indicate that the wells were drilled in the late 1940s and have been producing approximately 65,000 tons of evaporated salt per year since 1973. A sonar survey of brine well No. 1 was performed in 1986 (Morton, 1986) indicating a maximum cavern depth of 1520 feet and a radius of 75 feet. Brine well No. 2 was sonar surveyed in 1978 (Morton, 1978) and showed a cavern depth of 960 feet and a maximum radius of 225 feet. Based on these surveys, the minimum salt thickness between a solution cavern and the oil-filled area is about 1400 feet.

TABLE 3.1

SUMMARY OF CORE HOLES
DRILLED THROUGH SERVICE SHAFT LINING

Core Number	Approximate Elevation (ft-MSL)	Concrete Thickness (ft)	Depth To Salt (ft)	Cast Found	Iron Thick. (ft)	Asphalt Thickness	Void Thickness (ft)	Remarks
1	40.5	0.64		NA				
2	40.0	0.67		Y				
3	39.0	0.62		NA				
4	30.0	0.63		Y				
5	20.0	0.67		NA				
6	20.5	0.65		Y				
7	20.0	0.69		NA				
8	6.0	0.81		Y				
9	6.0	0.78		Y				
10	6.0	1.10		Y				
11	-18.0	0.48		Y				Water drips
12	-30.5	0.84		Y	0.125			Flow test port
13	-38.0	0.46		Y				Water flow
14	-38.0	0.40		Y				Water drips
15	-38.0	0.43		Y				
16	-42.0	0.42		Y	0.125			
17	-46.0	1.00		Y				
18	-47.0	0.79		Y				Water drips
19	-47.0	0.60		NA				Brine flow
20	-47.0	0.55		Y				
21	-47.0	0.88		Y				Water drips
22	-48.0	0.72		Y	0.125			Flow test port
23	-48.5	0.69		Y	0.125			Pressurized water
24	-50.5	>4.25		N				Dry concrete
25	-53.0	1.01		NA				Water drips

See Figure 3.2 for locations of cores.

TABLE 3.1

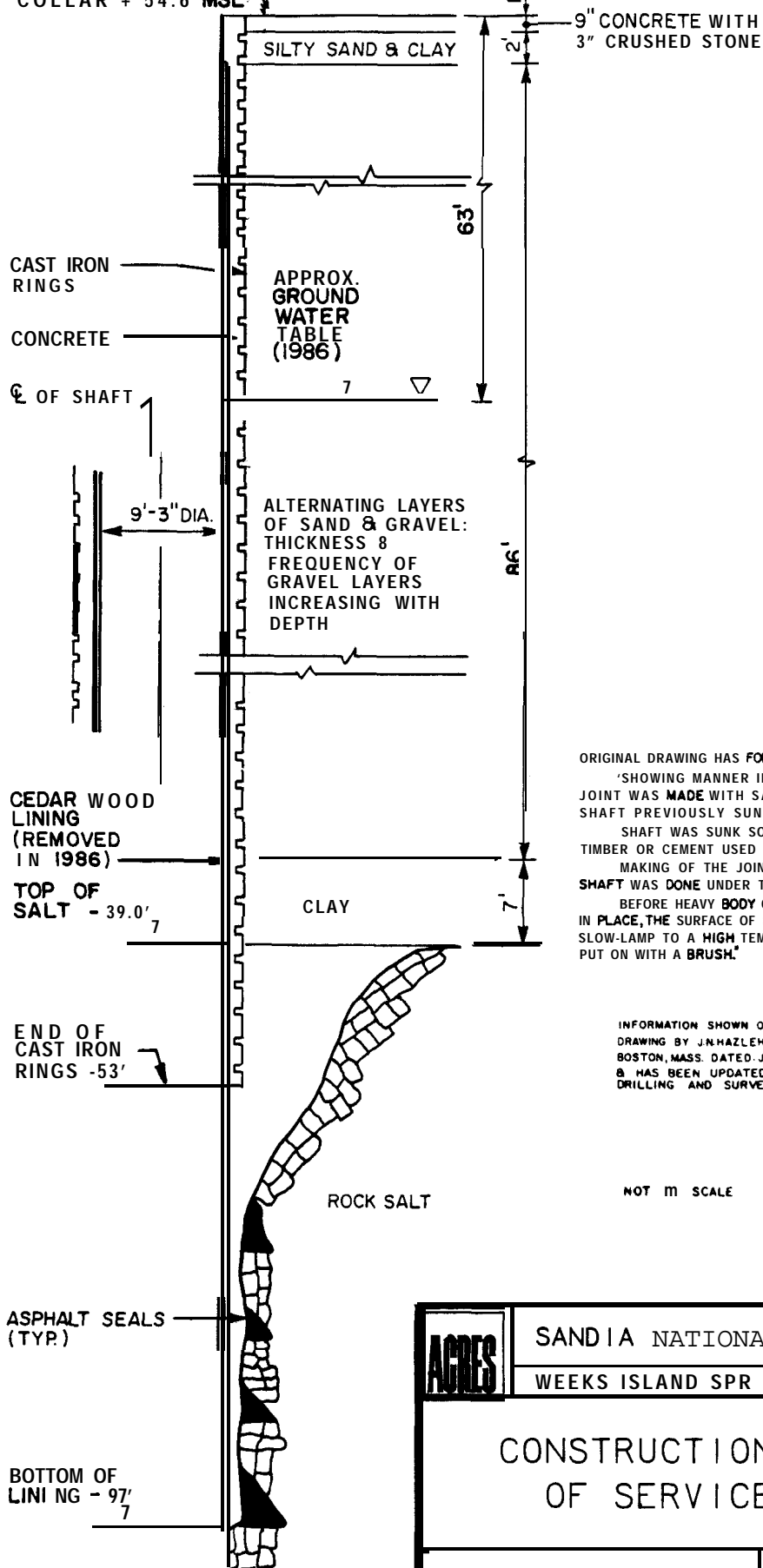
SUMMARY OF CORE HOLES
DRILLED THROUGH SERVICE SHAFT LINING

(Cont'd)

Core Number	Approximate Elevation (ft-MSL)	Concrete Thickness (ft)	Depth To Salt (ft)	Cast Iron Thick. (f t) Found	Asphalt Thickness (ft)	Void Thickness (ft)	Remarks
26	-53.0	0.45	1.83	Y		1.21	Water and sand
27	-53.0	0.48		Y			
28	-57.0	1.17		Y			
29	-58.0	1.25		Y			
30	-58.0	0.90		Y			
31	-59.0	0.90		Y			
32	-62.0	1.42	2.21	N	0.79		Asphalt and water
33	-62.0	1.70	1.83	N	0.13		Asphalt and water
34	-62.0	1.29	NA	N			Dry asphalt
35	-66.0	1.19	1.19	N			
36	-66.0	1.19	1.19	N			
37	-71.0	0.87	1.02	N	0.15		Water drips
38	-73.0	1.58	1.75	N	0.17		Asphalt and water (high pressure)
39	-78.0	NA	NA	N			No void to salt; drilled to 12 ft
40	-78.0	NA	NA	N			No void to salt; drilled to 12 ft
41	-78.0	NA	NA	N			No void to salt; drilled to 12 ft
42	-78.0	NA	NA	N			No void to salt; drilled to 12 ft
43	-78.0	NA	NA	N			No void to salt; drilled to 12 ft
44	-78.0	0.83	NA	N			No void to salt; drilled to 12 ft
45	-81.0	0.46	NA	N			No void to salt
46	-82.0	1.00	NA	N			No void to salt
47	-83.0	3.00	NA	N			Clay & sand; asphalt followed
48	-88.0	1.69	NA	N			No void to salt
49	-91.0	0.83	NA	N			
50	-95.0	3.45	5.00	N	1.55		

See Figure 3.2 for locations of cores.

TOP OF CONCRETE
COLLAR + 54.6' MSL



ORIGINAL DRAWING HAS FOLLOWING NOTES:

SHOWING MANNER IN WHICH WATER TIGHT JOINT WAS MADE WITH SALT ROCK AND CAST IRON SHAFT PREVIOUSLY SUNK BY THE COMPANY.

SHAFT WAS SUNK SO FEET DEEPER, BUT NO TIMBER OR CEMENT USED FOR THAT PORTION.

MAKING OF THE JOINT AND LINING THE CAST IRON SHAFT WAS DONE UNDER THE PNEUMATIC PROCESS.

BEFORE HEAVY BODY OF ASPHALT OR CEMENT WAS PUT IN PLACE, THE SURFACE OF SALT ROCK WAS HEATED WITH SLOW-LAMP TO A HIGH TEMPERATURE AND HOT ASPHALT PUT ON WITH A BRUSH.

INFORMATION SHOWN ON THIS DRAWING TAKEN FROM DRAWING BY J. HAZLEHURST, CONSULTING ENGINEER BOSTON, MASS. DATED JULY 27, 1901, FOR MYLES SALT CO. LTD. & HAS BEEN UPDATED TO INCORPORATE RESULTS OF 1986 DRILLING AND SURVEY PROGRAM BY DOE.

ACRES

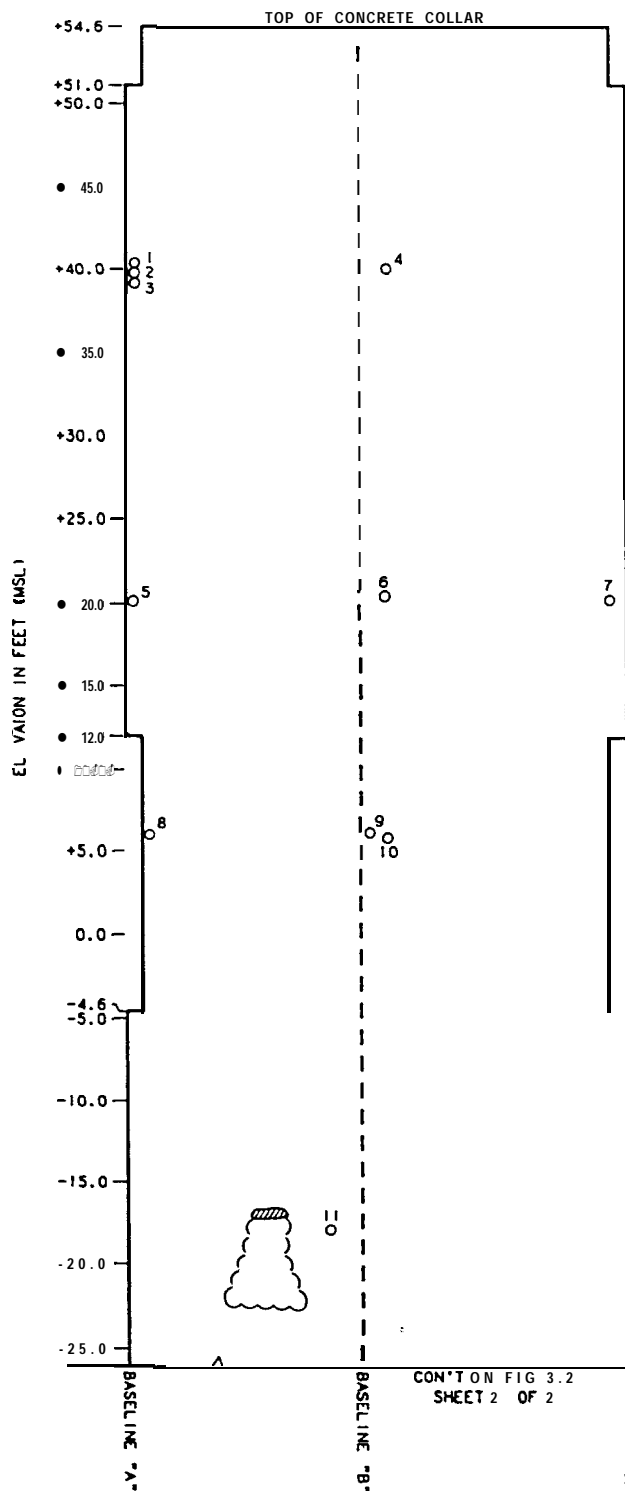
SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

CONSTRUCTION DETAILS
OF SERVICE SHAFT

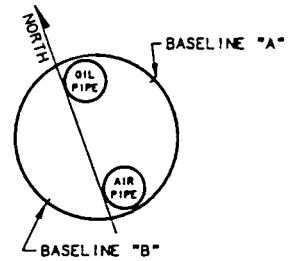
ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 3. I

MAY 1987



CON'T ON FIG 3.2
SHEET 2 OF 2



NOTES:

1. THE INFORMATION SHOWN ON THIS FIGURE WAS TAKEN FROM ROLL OUT VIEW OF SERVICE SHAFT SHOWING CORING DETAILS. SIMON J. FREYJOU & ASSOCIATES, INC., NW IBERIA, LOUISIANA. SJF JOB 86-84, NOVEMBER 13, 1986.
2. REFER TO TABLE 3.1 FOR SUMMARY OF CORES.

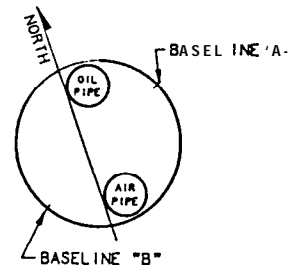
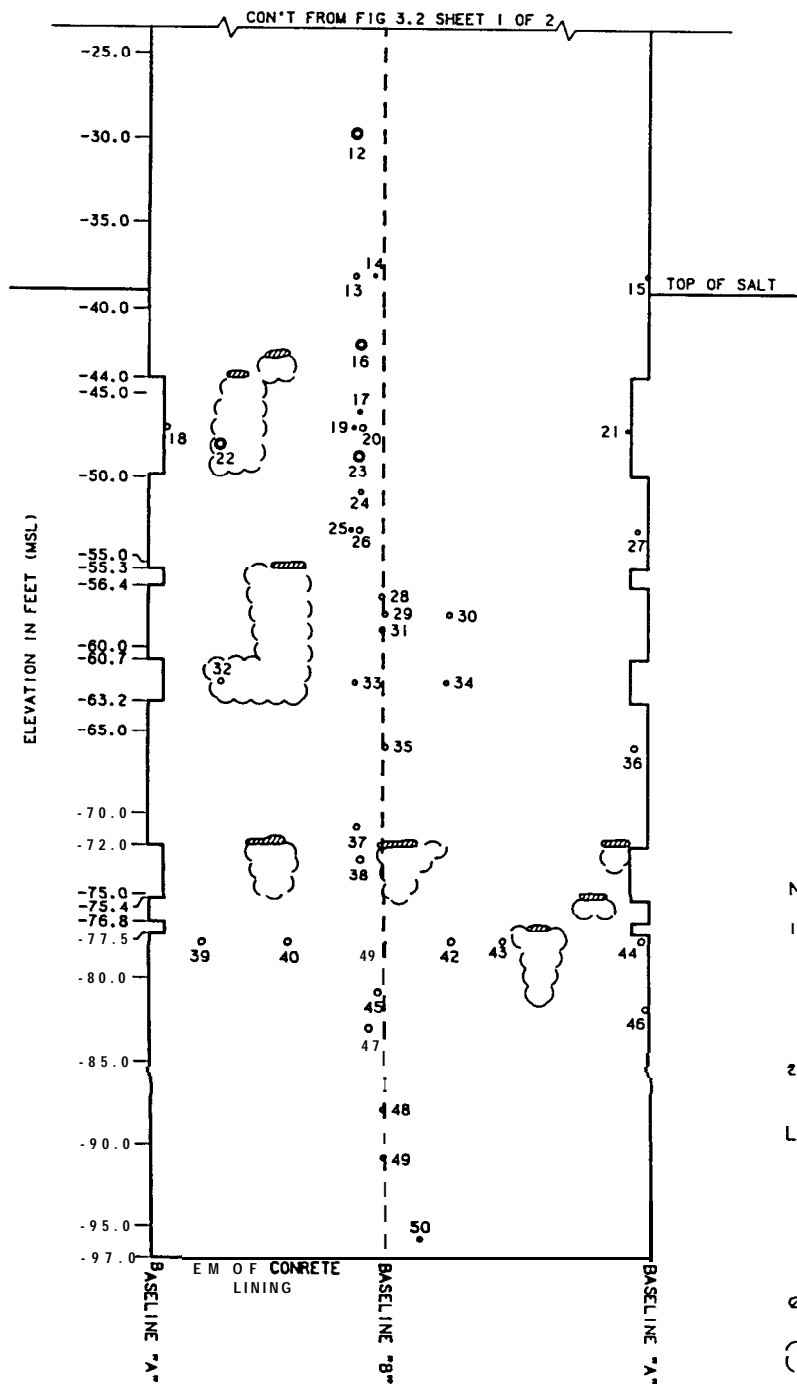
LEGEND:

- CORE THROUGH CONCRETE LINING
- CORE THROUGH CONCRETE LINING AND CAST IRON RING
- 36 CORE NUMBER
- ▨ SEEPAGE AREA
- ☁ WET AREA

SCALE 0 7.5 15 FEET

FIGURE 3.2

AMES	SANDIA NATIONAL LABORATORIES	
	WEEKS ISLAND SPR SITE	
	ROLLOUT VIEW OF SERVICE SHAFT SHEET 1 OF 2	
	ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 3.2 MAY 1987



NOTES:

1. THE INFORMATION SHOWN ON THIS FIGURE WAS TAKEN FROM "ROLL OUT VIEW OF SERVICE SHAFT SHOWING CORING DETAILS". SIMON J. FREYJOU & ASSOCIATES, INC., NW IBERIA, LOUISIANA, SJF JOE 86-84, NOVEMBER 13, 1986.
2. REFER TO TABLE 3.1 FOR SUMMARY OF CORES.

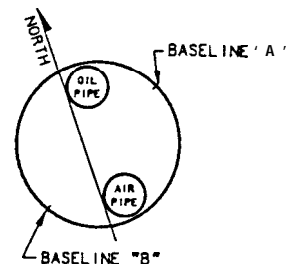
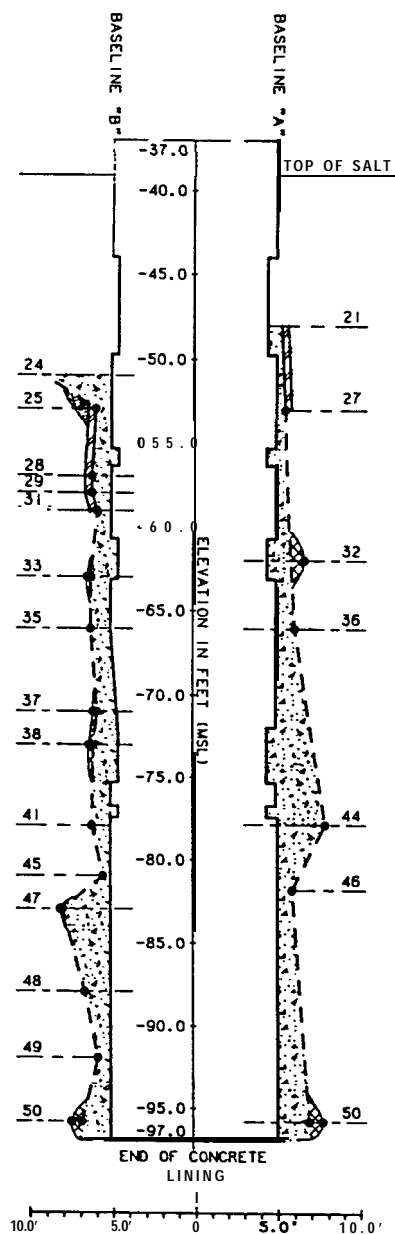
LEGEND:

- CORE THROUGH CONCRETE LINING
- CORE THROUGH CONCRETE LINING AM CAST IRON RING
- 36 CORE NUMBER
- SEEPAGE AREA
- WET AREA

SCALE 0 7.5 15 FEET

FIGURE 3.2

ACRES	SANDIA NATIONAL LABORATORIES WEEKS ISLAND SPR SITE
ROLLOUT VIEW OF SERVICE SHAFT SHEET 2 OF 2	
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 3.2 MAY 1987



NOTES:

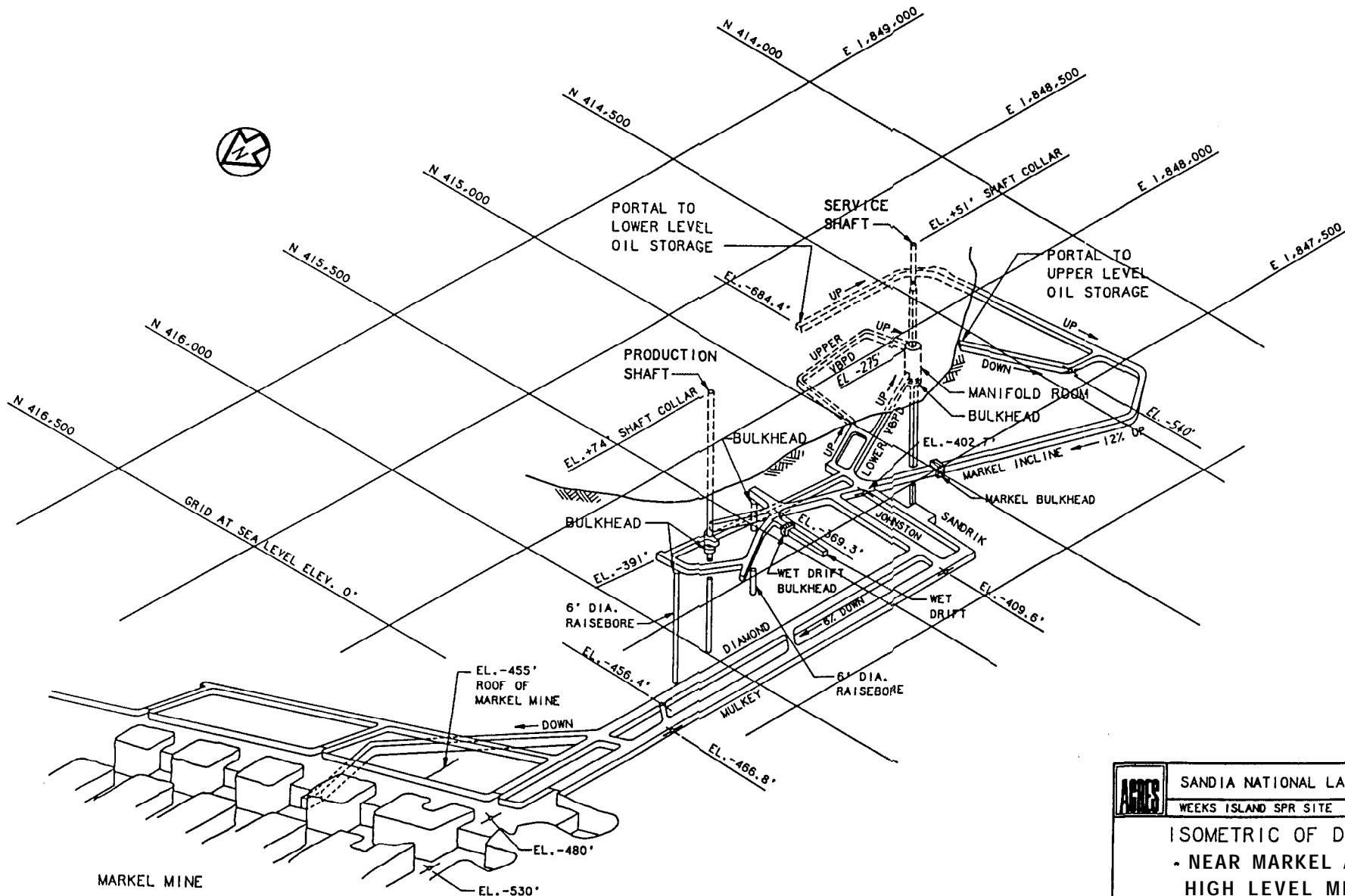
1. THE INFORMATION SHOWN ON THIS FIGURE WAS TAKEN FROM 'PROFILE VIEW OF BASELINES 'A' AND 'B' OF SERVICE SHAFT', SIMON J. FREYJOU & ASSOCIATES INC., NEW IBERIA, LOUISIANA, SJF JOB 86-84, NOV. 13, 1986.
2. REFER TO FIGURE 3.2 FOR LOCATION OF CORES
3. REFER TO TABLE 3.1 FOR SUMMARY OF CORES.

LEGEND:

- 46 — CORE NUMBER AND APPROXIMATE LOCATION
- CONCRETE
 - SOIL
 - METAL
 - ASPHALT

SCALE 0 7.5 15 FEET

FIGURE 3.3



	SANDIA NATIONAL LABORATORIES
	WEEKS ISLAND SPR SITE
ISOMETRIC OF DRIFTS - NEAR MARKEL AND HIGH LEVEL MINES	
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 3.4

MAY 1987

4 - SURFACE AND NEAR-SURFACE GEOLOGY

4.1 - Introduction

The Weeks Island salt dome lies within the Gulf Coast section of the Coastal Plain physiographic province, which is locally characterized by flat-lying Pleistocene to Recent unconsolidated deltaic sediments. The near-surface deltaic sediments are generally related to depositions which occurred as a result of changes in runoff and sediment supply in the Mississippi Basin during the glacial and interglacial periods following the Illinoian ice advance in more northern latitudes, together with changes in sea level.

Structurally, the area lies in the middle of a geosynclinal basin. Sediment thickness in the vicinity of Weeks Island is known to be in excess of 30,000 feet. The source bed for the salt dome is the **Louann** Salt of Jurassic age (approximately 180 million years ago) which is estimated to lie at a depth of 30,000 to 37,000 feet below the ground surface. The upward movement of the Weeks Island salt mass may have begun during the Oligocene period (26 million years ago), and still continues at present, at a rate of approximately 0.1 inches (2.5 mm) per year (see Section 5.6). This upward movement has pushed the overlying sediments upward and resulted in a surficial expression as a roughly circular "island" or dome with a diameter of approximately two miles and a maximum relief of 170 feet. The "island", which is surrounded by swamps, is located in an area of generally low relief and poor drainage.

4.2 - Surface Topography

Surface topographic features on Weeks Island are largely the result of differential subaerial erosion of the uppermost sand

unit, the **Alton** sand (see Section 5.2). Areas of the island where this sand unit is overlain by a clay cap have eroded more slowly than those where the sand is exposed, thereby forming topographic highs (Figure 2.2). For the most part, these areas are stabilized by vegetation, particularly the live oaks which grow well in areas of clayey soil. These live oaks have elaborate root systems and tend to hold soil in place, while the rapidly growing sweet bays and magnolias, which grow in sandy areas, are easily ripped out by hurricanes, making these areas more subject to erosion.

The most prominent topographic feature on the island is a ridge running across the center of the island at an orientation of approximately **N10°E** (Figure 2.2). This ridge, which is topped by clay lenses, is commonly referred to as the "Devil's Backbone" and forms the highest elevation (171 feet) on the island. East of the Devil's Backbone lies a linear trough approximately 1500 feet wide which contains Sandy Bottom Pond. This trough, which parallels the Devil's Backbone, is bounded by graben-type faults on the east and west. A further discussion of specific faults is provided in Section 5.5.

The surface of the western half of the island is composed of a series of steep-sided, clay-capped terraces dissected along small faults described in Section 5 and shown on Figure 5.6. Differential movement and uplift within the underlying salt mass has produced resultant differential upward movement in these overlying sediments, forming these faults along which erosion has taken place. Areas which are capped by the clay and stabilized by thick vegetation have remained as small plateaus and knobs; whereas the underlying sand erodes rapidly, forming steep valleys and gullies (Figure 2.2).

4.3 - Stratigraphy

Stratigraphy of the near-surface sediments in the vicinity of the dome was developed by Acres (1986) and further refined with additional data obtained from the present analysis. The shallow stratigraphy overlying and immediately adjacent to the dome is shown on the geophysical electric log in Figure 4.1. Several representative cross sections across the dome are shown on Figures 4.2 through 4.5. A brief description of these shallow units follows.

Cary Sand and Clay and Wisconsin Sand (CS, CC, WI)¹

The uppermost unit of the near-surface stratigraphic sequence in the vicinity of the dome is composed of Cary Wisconsin age clays, sands, and gravels. On the dome, this unit is only found directly along the Devil's Backbone (Figure 2.2).

Two Creeks Clay (2C)

Immediately below the Wisconsin sediments and forming the upper unit in the stratigraphic sequence overlying the dome is the Two Creeks Clay, which is also referred to as the Beaumont Clay (Figures 4.1 through 4.5). This is a stiff, brown, silty clay which ranges in thickness up to approximately 40 feet. Water contents within this clay are generally between 25 and 45 percent. No permeability data are available for the Two Creeks **Clay**, but it is likely that the permeability is very low, on the order of 10^{-6} cm/sec or less. The clay is discontinuous over the dome.

¹See Table 5.1 for summary of all stratigraphic units.

Alton Sand and Gravel (A)

The **Alton** (or Prairie) Sand forms a sequence of alternating layers of rust-orange sandy gravel, and silty sand underlying the clays, and ranges in thickness from 90 to 240 feet (Figures 4.1 through 4.5 and 5.6). Silt or clay lenses occur at various depths within this stratum. The lenses are generally thin and discontinuous over the dome. Where drilled, these sands and gravels appear to be medium to dense. Composite grain size distribution taken in a previous study is shown in Figure 4.6 (Acres, 1986).

Sangamon Clay (S)

Beneath the **Alton** are thin, discontinuous lenses of the interglacial black, marine clay known as the Sangamon Clay of Illinoian age (Figures 4.1 through 4.5). This clay is found only locally on top and along the flanks of the salt dome.

Illinoian Sands and Gravels (I)

Beneath the Sangamon Clay are the Illinoian sands and gravels related in age to the Illinoian glacial period. These sands and gravels are only found flanking the dome (Figures 4.1 through 4.3).

Peoria Clay (P)

Below the Illinoian sands and gravels is a thick dark marine clay of Peorian age. Its top is used as the most accurate subsurface stratigraphic marker in the area (Figures 4.1 and 5.7).

Kansan Sand (KA)

The Kansan sand, of Kansan age, is found beneath the Peoria Clay and provides the shallowest hydrocarbon production in the area (Figure 4.1).

Nebraskan Sand (NE)

The lowest Pleistocene beds at Weeks Island are sands and gravels of Nebraskan age which lie **unconformably** on top of the Pliocene (Figure 4.1). These sands and gravels thicken away from the dome with their thickest being to the northwest.

The general relationship of these various near-surface **stratigraphic** units to the salt dome is shown on Figures 4.1 through 4.5. Detail soil properties of the sediments over the dome are found in Acres study (1986).

4.4 - Geohydrology

(a) Surface Water

The Weeks Island dome is surrounded by an area of extremely low relief which is essentially at sea level. This surrounding area is composed of heavily vegetated swamp, crossed by bayous or drainage channels which lead to the sea at Weeks Bay (Figure 2.2). Many of these bayous have been deepened, extended and widened to provide access to drilling sites adjacent to and in the vicinity of the Weeks Island dome.

To the west of the dome, following a northwest-southeast course, is the Intracoastal Waterway, (Figure 2.2) which cuts through an area of swamp separating the dome area from Weeks Bay immediately to the west. Bayous in the

vicinity of the dome form a circular, roughly dendritic drainage pattern, draining westward towards Weeks Bay. Bayous to the north and east of the dome (Weeks Bayou and Warehouse Bayou, Figure 2.2) generally drain in a counter-clockwise direction around the dome, while those to the south drain in a clockwise direction. Flow within the bayous and the swamps is largely controlled by tidal fluctuations. Salinity within the bayous and swamps generally decreases in an upstream or **landward** direction (generally northeast).

The only natural freshwater pond is Sandy Bottom Pond in the northeast quadrant of the island (Figure 2.2). Plantation Lake and the ponds in the northwest quadrant of the island were created by damming the shallow valleys which drain toward the surrounding swamps. These freshwater ponds are not underlain by impermeable clays and drainage of the ponds is downward through the permeable sands and gravels into the ground water table. Their surface levels correspond with the ground water table which fluctuates seasonally as a result of precipitation intensity.

A saltwater pond (Devil's Pond) is located at the western periphery of the island within the swamps between the Intracoastal Waterway and Weeks Island (Figure 2.2). This pond is hydraulically connected to Weeks Bay and its surface elevation is subject to tidal fluctuations.

(b) Ground Water

The ground water regime over the dome is a single aquifer. The ground water table was defined by installation of four piezometers, which indicated that the water table was

essentially at sea level (Figure 4.7) (Acres, 1986). All four of the piezometer tips were placed near the **top-of-salt**. Therefore, the below sea level reading shown on Figure 4.7 reflects the near-saturated (denser) condition of the ground water in this area. This is confirmed by geophysical logs which show the salinity of the ground water increasing with depth, reaching near-saturation at approximately 12 feet above the top-of-salt (Figure 4.8). No persistent excess hydrostatic head appears to exist over the dome, and there is no evidence of ground water flows across the dome. Permeability tests performed on samples of the units above the dome indicate values of approximately 10^{-6} cm/sec for the discontinuous Sangamon Clay lying immediately above the salt at the Service Shaft; 3×10^{-4} cm/sec for the **Alton** sand; and 0.5 to 1.0×10^{-2} cm/sec for gravel layers within the **Alton** (Acres, 1986). The ground water flow through the sediments will be governed by the most permeable members; in this case, the sands and gravels.

The ground water regime appears to be the result of infiltration of precipitation downwards through the permeable members of the strata and then radially off the dome toward the surrounding bayous, Intracoastal Waterway and Weeks Bay (Figure 2.2). Salinity increases gradually from the island to the adjacent bay.

In the event that the ground water table above the salt were lowered for any reason (for example, by leakage through the salt into the underground workings or by pumping out the aquifer above the dome), then water would flow inward from the surrounding waterways. Such water would not be saturated and the rate of solutioning of the dome

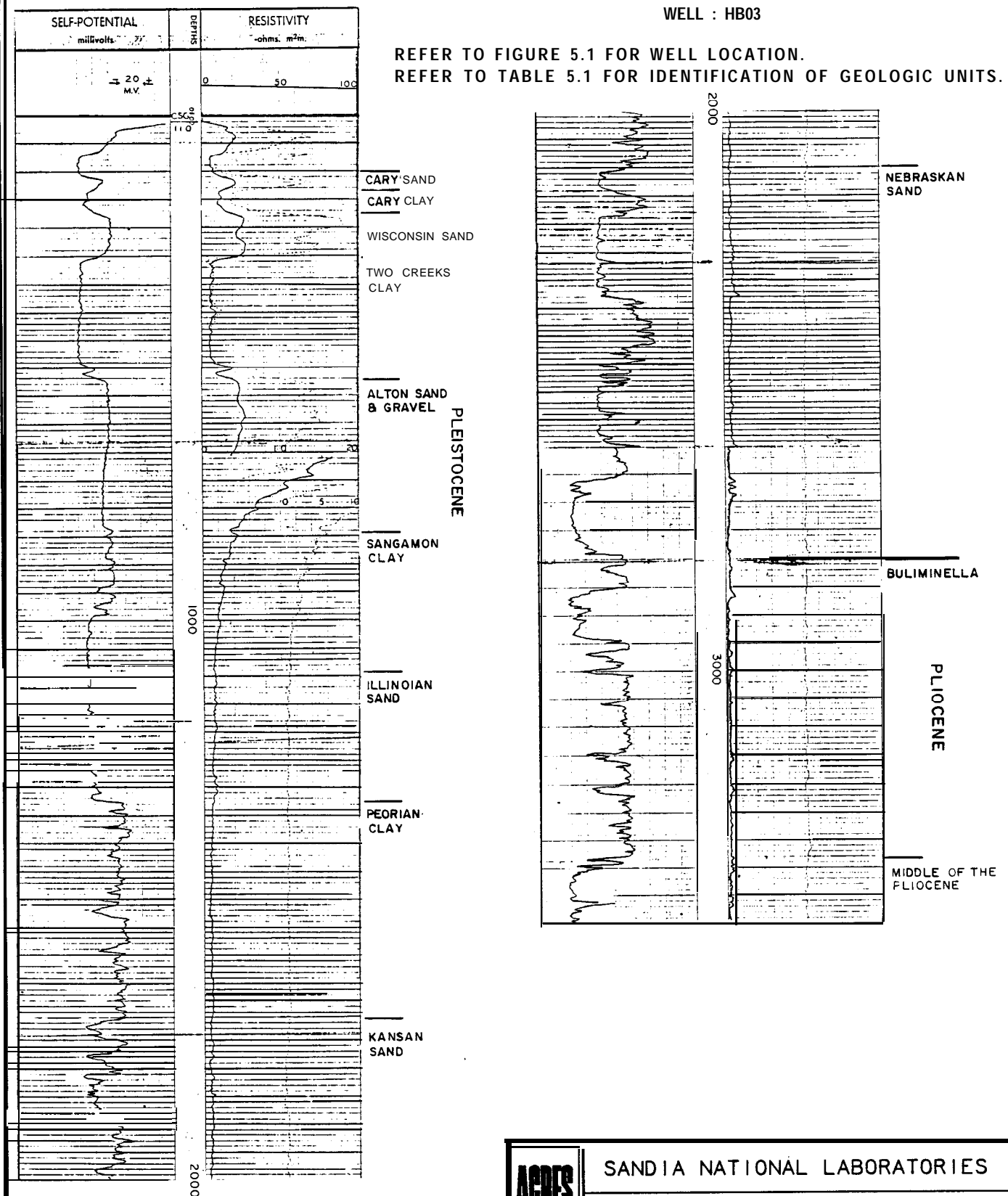
would increase. The number and capacity of the high permeability gravel zones above and around the dome are such that high inflow and recharge rates would be achieved.

Significant characteristics of the ground water regime were summarized in Acres (1986) and include:

- The ground water regime over the dome is a single, continuous aquifer.
- The discontinuous nature and low permeability of the few silt **and** **clay** lenses do not provide a ground water barrier above the dome.
- Ground water flows above the dome occur predominantly through the gravels.
- During dry periods, the elevation of the ground water table is controlled by the surrounding sea level, allowing for density differences due to salinity.
- Precipitation on the island is the normal source of recharge for the aquifer.
- Ground water recharge would flow inward from the surrounding sea water channels in the event the water table above the salt were artificially drawn down.
- Aquifer salinity increases with depth and becomes fully saturated approximately 12 feet above the salt.

WELL : HB03

REFER TO FIGURE 5.1 FOR WELL LOCATION.
REFER TO TABLE 5.1 FOR IDENTIFICATION OF GEOLOGIC UNITS.



SANDIA NATIONAL LABORATORIES

WEEKS ISLAND SPR SITE

STRATIGRAPHIC COLUMN THROUGH PLEISTOCENE SEDIMENTS

ACRES INTERNATIONAL CORPORATION
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FIGURE 4. I



NOTES:

1. ALL BORING NUMBERS REFER TO "MY" LEASE ON FIGURE 5. 1.
2. REFER TO TABLE C.2A FOR IDENTIFICATION OF BORINGS.
3. SECTIONS SHOWN ON FIGURES 4.3, 4.4 AND 4.5.
4. ELEVATIONS IN FEET BELOW MEAN SEA LEVEL.

LEGEND:

- 74 BORING NUMBER AND LOCATION
- 0 SHAFTS TO DOE AND MORTON UNDERGROUND FACILITIES
- LIMITS OF MINE WORKINGS

— 420,000

— 415,000'

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 1000 2000 FEET

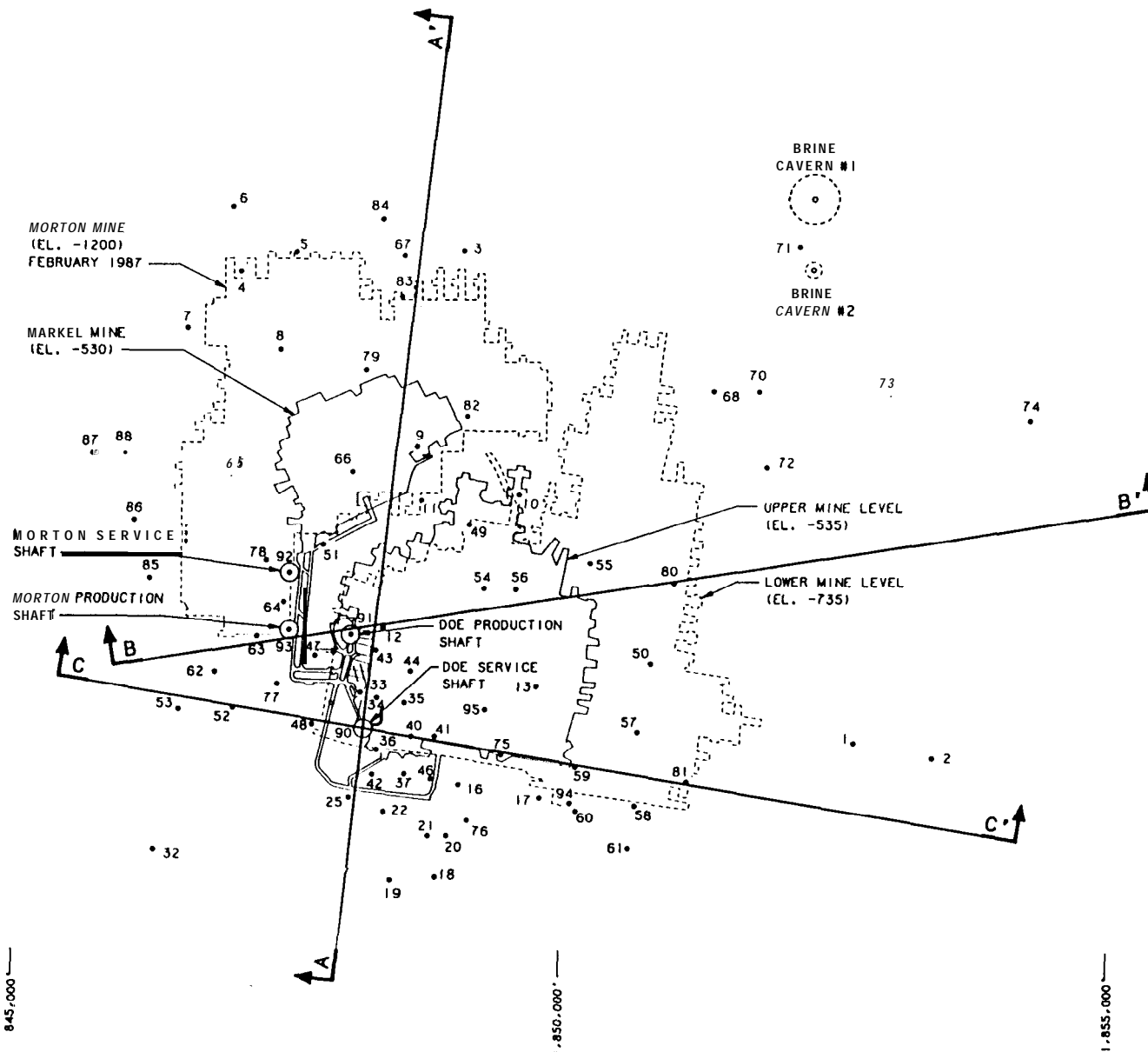
	SANDIA NATIONAL LABORATORIES
	WEEKS ISLAND SPR SITE
	LOCATIONS OF SHALLOW SECTIONS OVER TOP OF SALT DOME
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 4.2

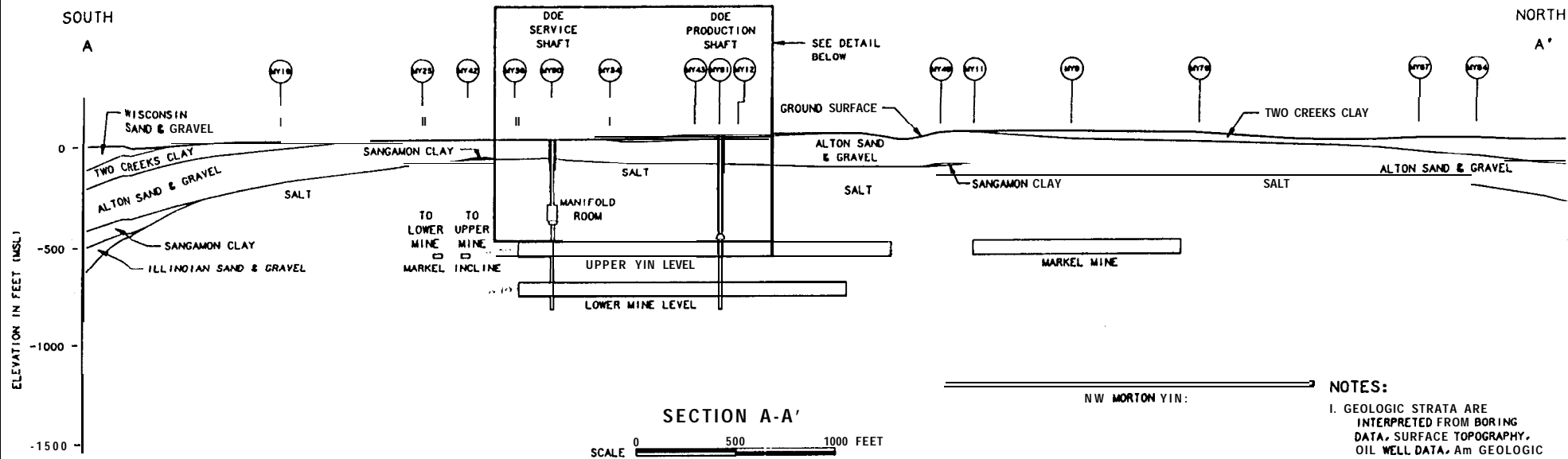
AY 1967

845,000

1,850,000

1,855,000





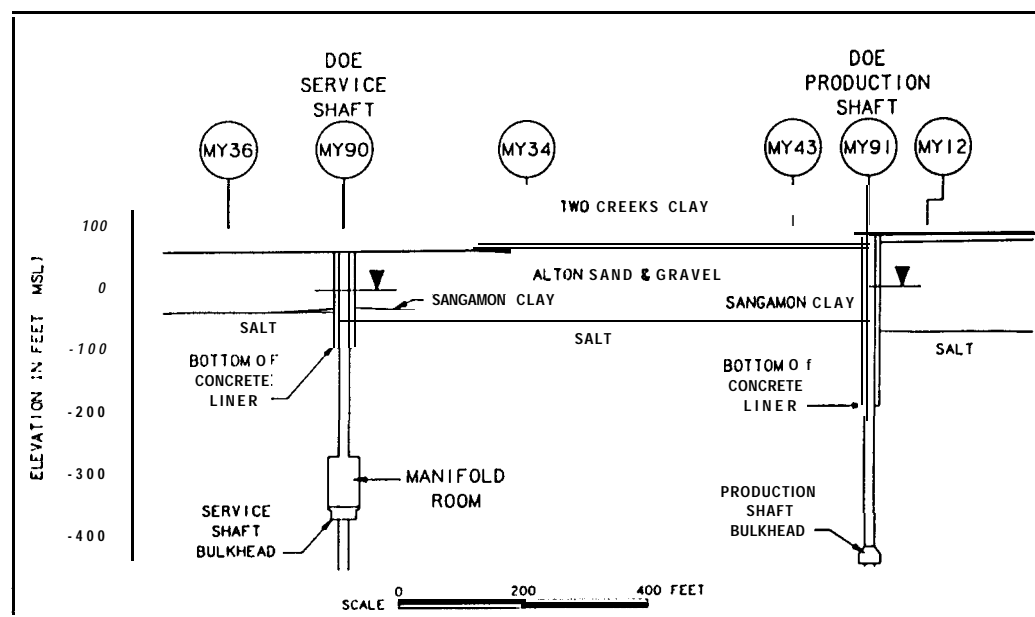
NOTES:

1. GEOLOGIC STRATA ARE INTERPRETED FROM BORING DATA, SURFACE TOPOGRAPHY, OIL WELL DATA, AND GEOLOGIC ASSESSMENT.
2. FOR BOREHOLE LOCATION AND DATA REFER TO FIGURE 5.2 AND TABLE C.2A.
5. REFER TO FIGURE 4.2 FOR LOCATION OF SECTION.

LEGEND:

- BORING NUMBER
 LOCATION
 GROUNDWATER LEVEL

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.



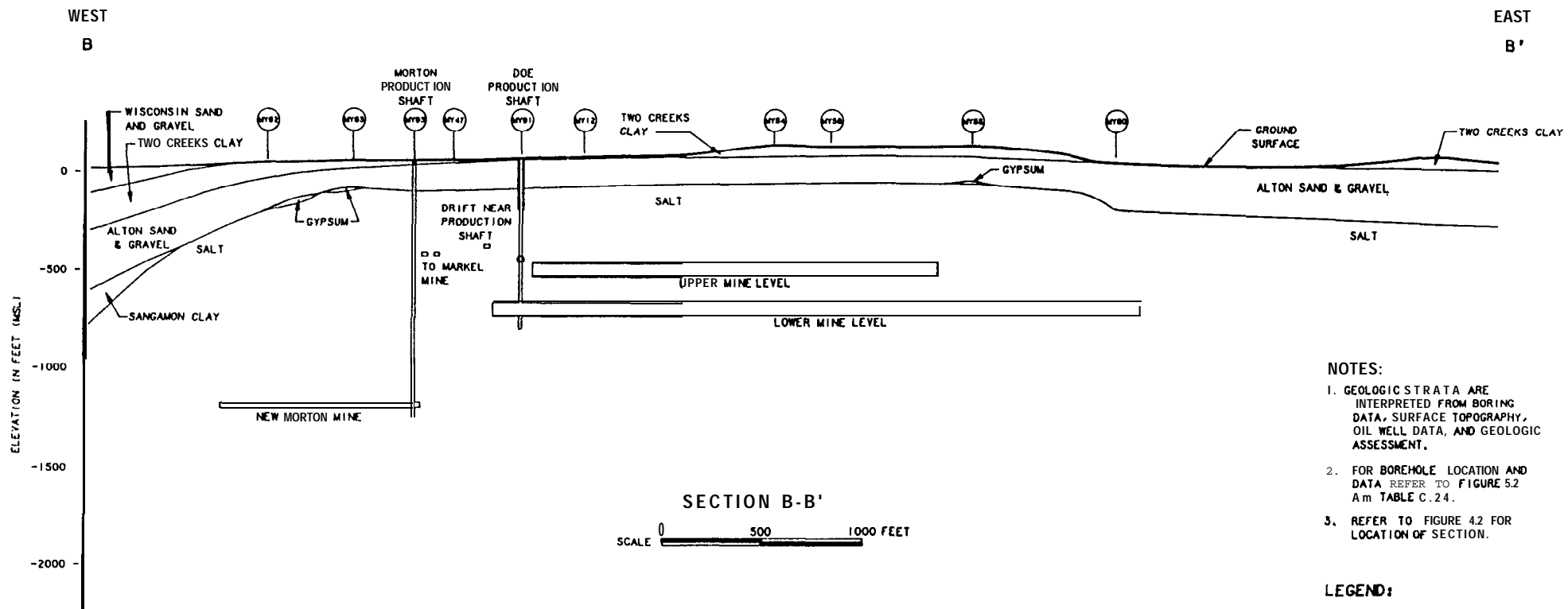
SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

SECTION A-A'

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FIGURE 4.3

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NOTES:

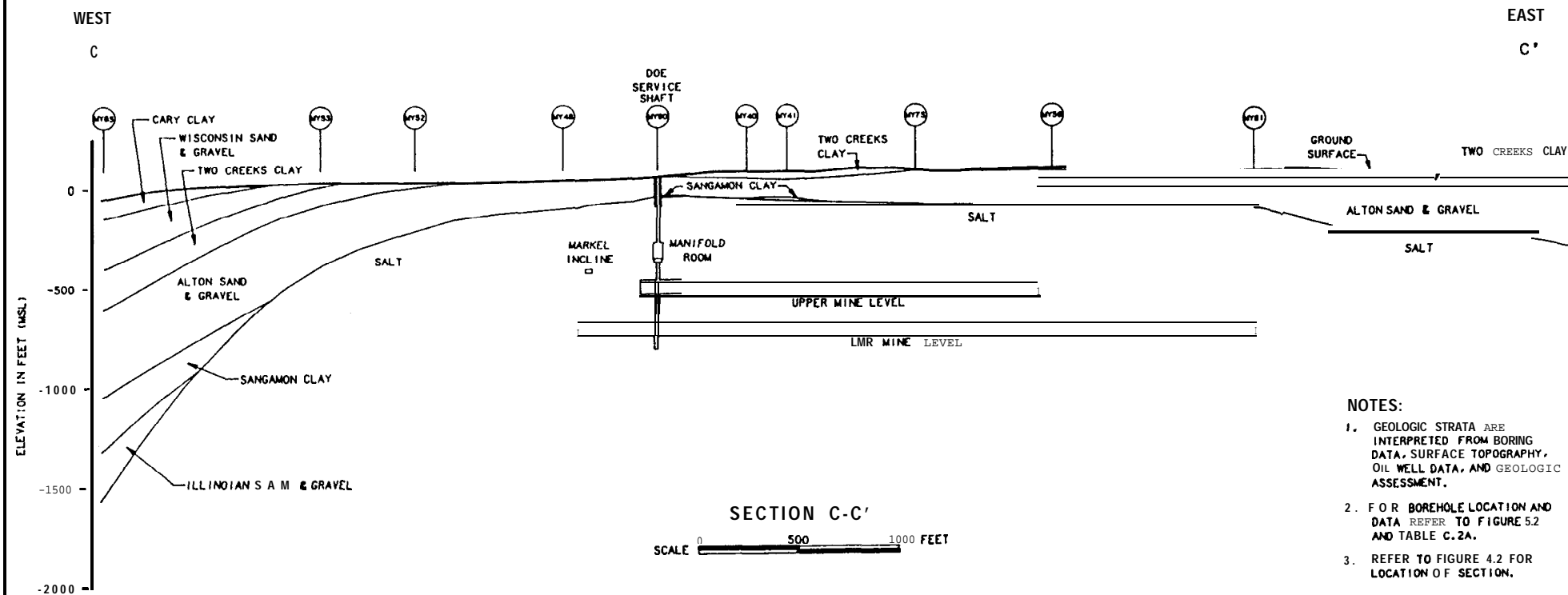
1. GEOLOGIC STRATA ARE INTERPRETED FROM BORING DATA, SURFACE TOPOGRAPHY, OIL WELL DATA, AND GEOLOGIC ASSESSMENT.
2. FOR BOREHOLE LOCATION AND DATA REFER TO FIGURE 5.2 A in TABLE C.24.
3. REFER TO FIGURE 4.2 FOR LOCATION OF SECTION.

LEGEND:

BORING NUMBER AND LOCATION

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

	SANDIA NATIONAL LABORATORIES WEEKS ISLAND SPR SITE
SECTION B-B'	
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 4.4



NOTES:

1. GEOLOGIC STRATA ARE INTERPRETED FROM BORING DATA, SURFACE TOPOGRAPHY, OIL WELL DATA, AND GEOLOGIC ASSESSMENT.
2. FOR BOREHOLE LOCATION AND DATA REFER TO FIGURE 5.2 AND TABLE C.2A.
3. REFER TO FIGURE 4.2 FOR LOCATION OF SECTION.

LEGEND:

MY89 BORING NUMBER AND LOCATION

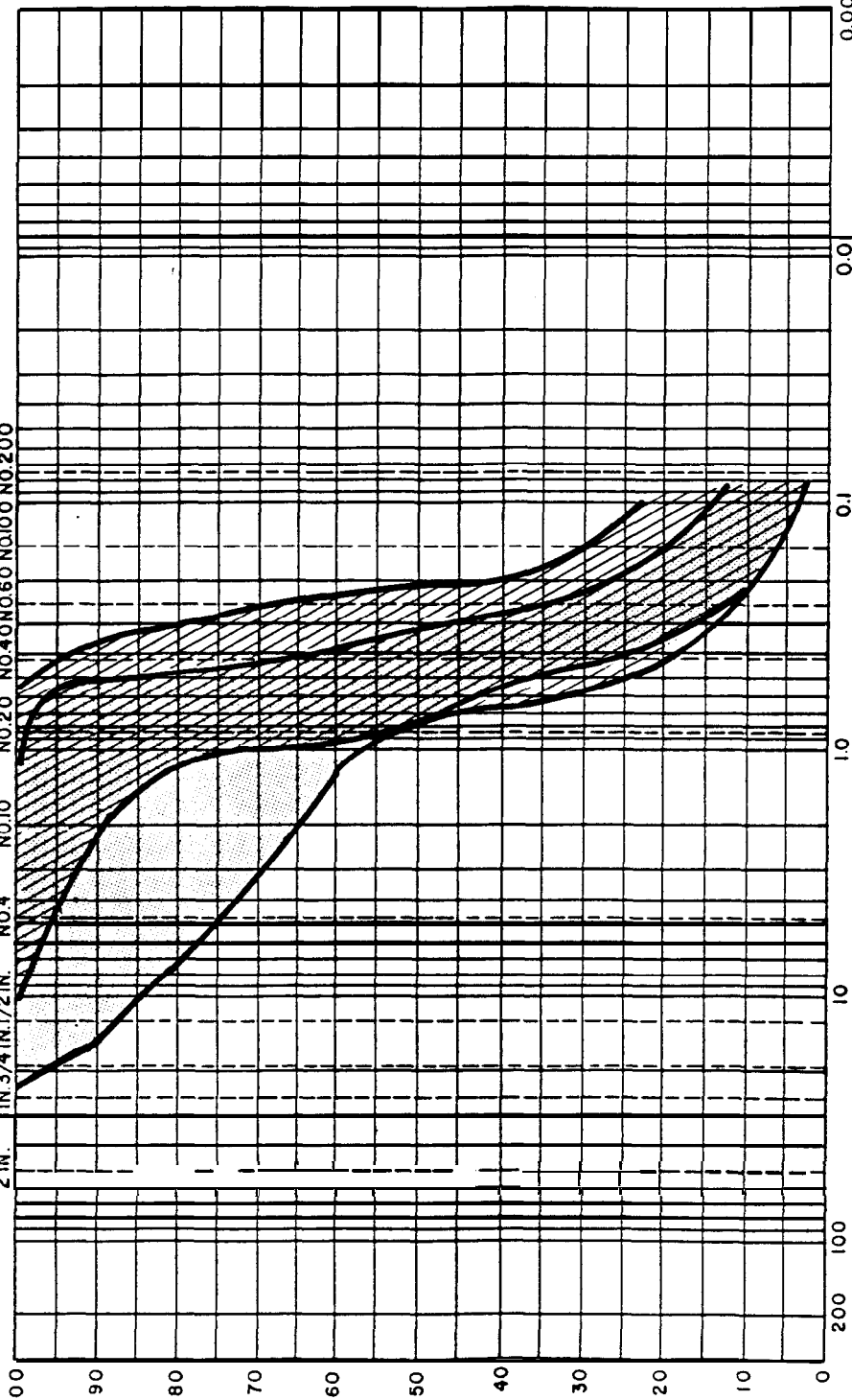
BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

ACRES	SANDIA NATIONAL LABORATORIES	
	WEEKS ISLAND SPR SITE	
SECTION C-C'		
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN		FIGURE 4.5

MAY 1987

U.S. STANDARD SIEVE SIZE

2 IN. 1 IN. 3/4 IN. 1/2 IN. NO. 4 NO. 10 NO. 20 NO. 40 NO. 60 NO. 100 NO. 200



GRAIN SIZE IN MILLIMETERS

COBBLES		GRAVEL		SAND		SILT OR CLAY	
COARSE	FINE	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

GRADATION ANALYSES 1986 STUDY

GRADATION ANALYSES Mc CELLAND 1977

SOURCE: ACRES (1986)



SANDIA NATIONAL LABORATORIES

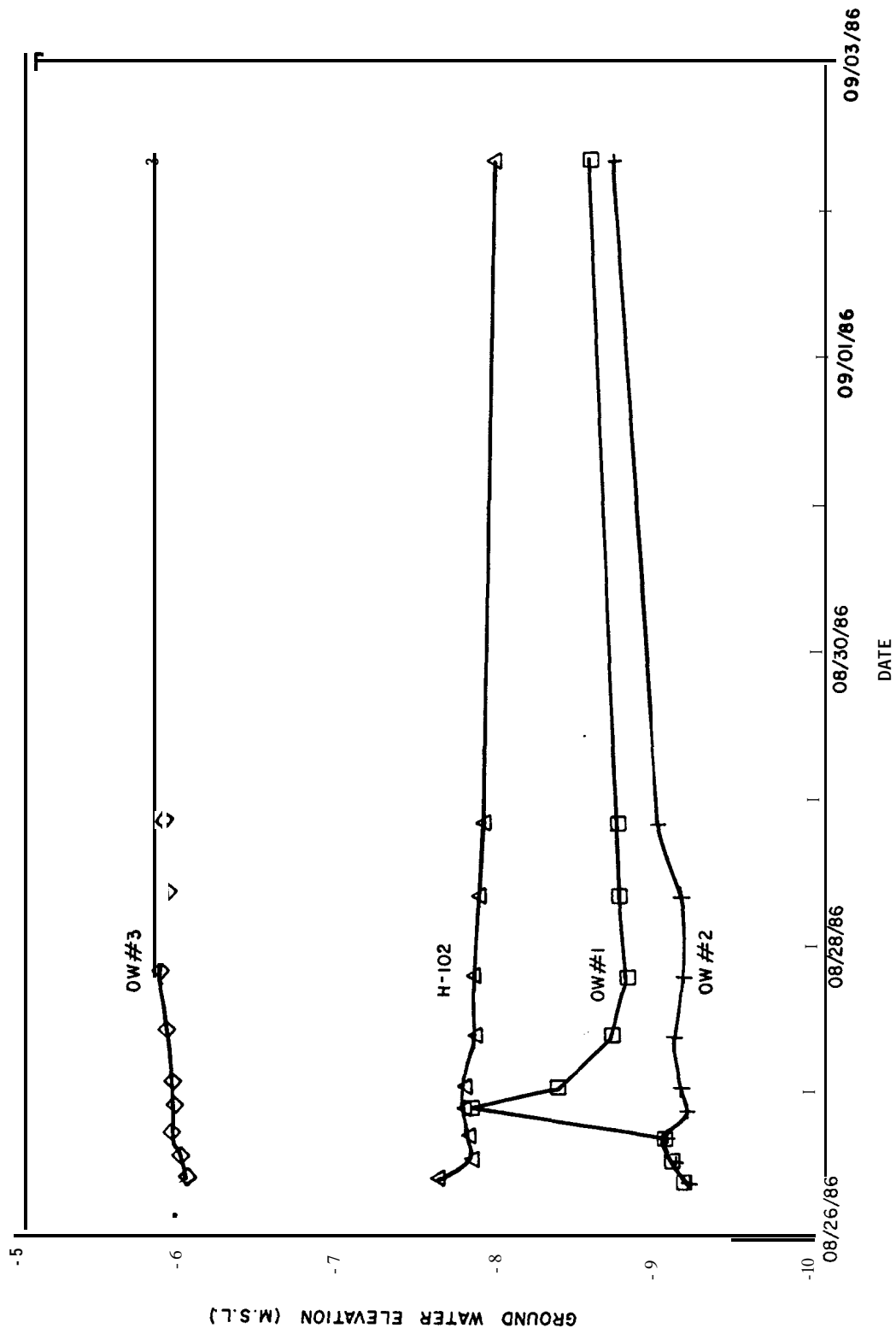
WEEKS ISLAND SPR SITE

GRADATION ANALYSES OF ALTON SAND AND GRAVEL

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FIGURE 4.6

MAY 1987



SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

OBSERVATION WELL READINGS

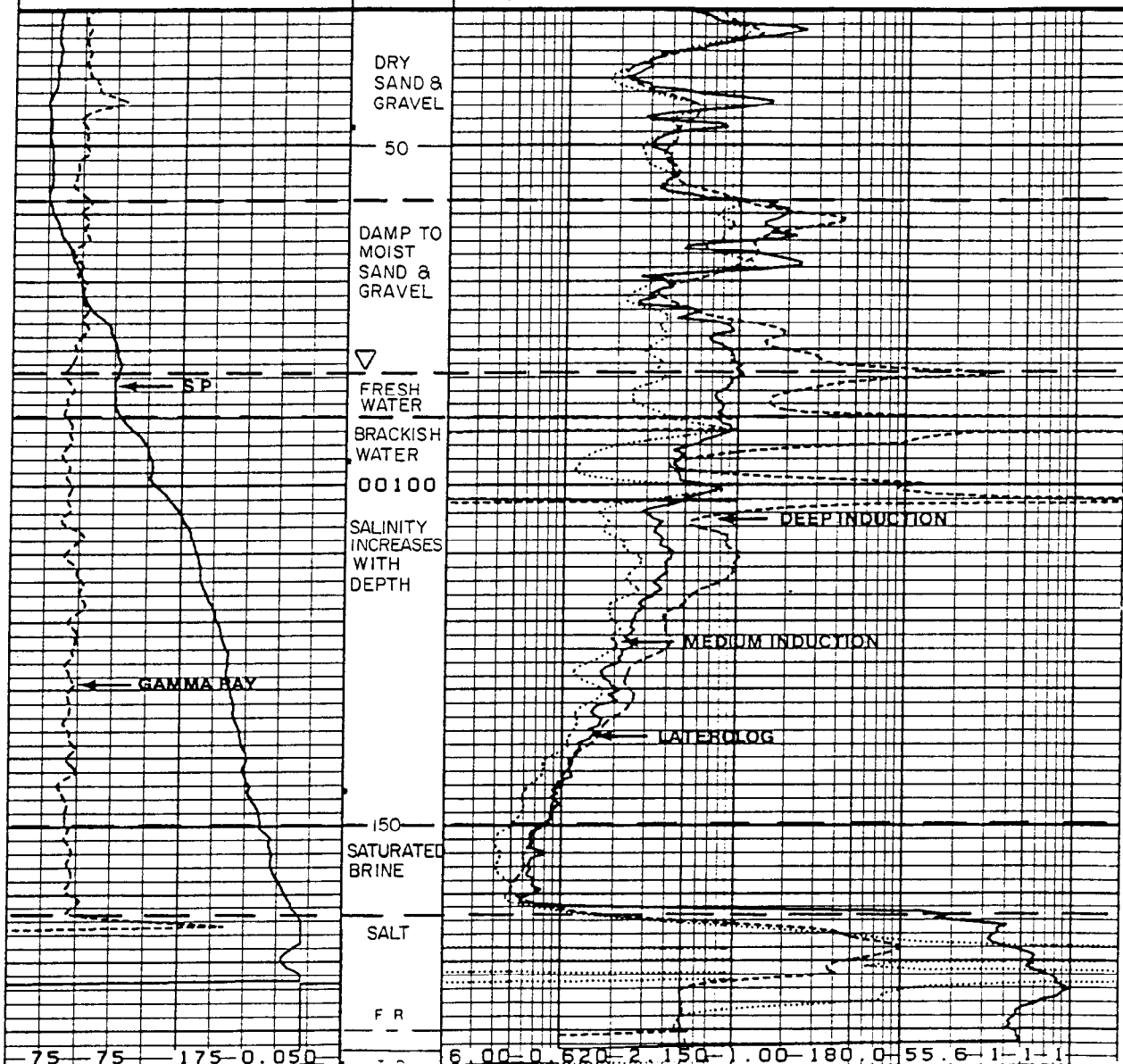
ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 4.7

MAY 1987

08-06-86 21:10 29.8 331175 0042-38 0 2

0	GR API	150	0.2	R(LLU) Ω -M	2000
			0.2	R(ILM) Ω -M	2000
			0.2	R(ILD) Ω -M	2000
25.0	SP MV	225.0			



0	GR API	150	0.2	R(LLU) Ω -M	2000
			0.2	R(ILM) Ω -M	2000
			0.2	R(ILD) Ω -M	2000
25.0	SP MV	225.0			



SANDIA NATIONAL LABORATORIES

WEEKS ISLAND SPR SITE

GAMMA RAY, SP, DUAL INDUCTION SURVEYS OF H-101

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 4.8

MAY 1987

5 - STRATIGRAPHY AND STRUCTURE IN AND AROUND THE DOME

5.1 - Introduction

As described in Section 2.4, data available from previous studies and investigations at and around the dome were used to determine the geologic and geotechnical characteristics of the salt stock and adjacent sediments. Data from borings above and around the dome (Figures 5.1 through 5.4 and Appendix C) were interpreted with respect to geology, structure and **stratigraphy**, and processed in the computer programs described in Appendix B. These programs were used to assist in the preparation of cross sections and contour maps at various locations and orientations to the salt dome. These were then used, together with conventional geologic interpretation techniques and other available data, to develop the geologic characterization of the salt dome and sediments immediately adjacent to it.

Presented in this section are the results of this interpretation with respect to stratigraphy, structure around the dome, dome geometry, dome structure, movement of the dome and salt properties.

5.2 - Stratigraphy

The stratigraphy of the Pleistocene, Pliocene and Miocene sediments surrounding the Weeks Island salt dome is summarized in Table 5.1. Stratigraphy of the near-surface sediments of Recent and Pleistocene age is shown on Figures 4.1 through 4.5 and described in Section 4.2. Surrounding the salt stock and lying beneath the Pleistocene sediments are beds of Pliocene and Miocene age.

Well log data obtained from oil and gas drilling around the dome was used to define the stratigraphy adjacent to the dome. Details of the wells and summaries of log interpretation of stratigraphic horizons are given in Appendix C. The characteristic log response was used in defining the stratigraphic and biostratigraphic zones. Wells from which data were used in this study (see Appendix C and Figures 5.1 through 5.4) only penetrated the Recent to Miocene age sediments; the older Oligocene deposits have never been reached at Weeks Island.

The Pliocene and Miocene sediments in the vicinity of Weeks Island were deposited in a shallow marine deltaic environment similar to that of the present day Mississippi delta area. A general stratigraphic column for the Pliocene and Miocene sediments is shown in Figure 5.5 and Table 5.1. Sands, silts, and clays were the major sediments deposited in this delta. Basically, the alluvial (river) sands were built out by the river over unstable marine clays as point bars in meander bends and deltaic deposits at the river mouth. These deposits formed a "sandpile" made up of stacked point-bars deposited together with thin alluvial silts. The base of the "sandpile" is made up of discrete marine sands deposited as delta-mouth bars and delta-front sand sheets over the marine muds of the continental slope. In addition to the complex stratigraphy and initial structure of the active-depositional delta edge sands, a few thinner sands were deposited on and at the base of the slope by turbidity currents (map unit SD and deeper beds on the north, map unit AB on the southwest: these units are described below).

As a result of this depositional environment, many of the Pliocene sediments in the Weeks Island area are non-marine in origin, and cannot be distinguished using micropaleontology. Therefore, the typical stratigraphic sequence of the Pliocene

sediments is not as well known as that of the Miocene marine sediments in the area. Most of the marine stratigraphy of the Miocene sediments have been identified by their distinct micropaleontologic foraminiferal fauna. This stratigraphic sequence, which has been well-established by the extensive oil and gas exploration undertaken throughout the region, is one of the best known sequences in the world. Therefore, correlating the biostratigraphic units with electric logs provides an excellent understanding of the structure and stratigraphy around the dome. Descriptions of the map units identified in Table 5.1 and Figure 5.5 are presented below.

Units TP and MP: These units unconformably underlie the Pleistocene sediments and represent the top and middle of the Pliocene. They are composed of alluvial silts, clays, and sands deposited as point bars inside river meanders. The TP unit represents the alluvial clays and thin sand units, whereas the MP unit represents the coarser alluvial sands and gravel fraction of the upper Pliocene. These point bar deposits show poor well-to-well correlation, although the uppermost point bar deposit within this unit is present in over one half of the wells and reaches a thickness of 100 feet. Other deposits within this unit reach thicknesses of approximately 50 feet. Overall, the unit generally varies between 300 - 600 feet. These deposits are generally double point bars with gravels at the base. This unit is thickest in the east-west trending rim **syncline** under the overhang on the north edge of the dome. The unit lies unconformably on top of the Miocene.

Unit MIO: The uppermost unit of the Miocene is mapped as the MIO. The top of this unit represents the top of the Miocene. This unit is characterized by sands deposited as point bars in river meanders.

Units L and 2L: This unit is the top of the section which is correlative with the Textularia L (L). Unit L is composed of alluvial point bar sands; however, without faunal evidence, it is extremely difficult to correlate this unit within the **strati-**graphy around Weeks Island. Within Unit L are shallow pre-glacial marine clays deposited in bays and offshore areas referred to as 2L. The source of the sediment is believed to have been fine mud from the Mississippi River transported by wind-driven marine currents. The unit is the shallowest marine clay at the site and serves as an excellent marker bed, containing abundant Textularia foraminiferal fauna used in well correlation.

Unit 2: Unit 2 is a thick sequence of regional marine clays and sands characterized by the Bigenerina 2 fauna. This unit is the lowermost of the stacked point bar deposits or "sand-pile" and represents what is often called the marine "breakout" zone where sand becomes separated by marine clays. The unit includes an upper point bar deposit from 200 to 500 feet thick and a lower transitional sand sequence or beach deposit. The unit represents the transition from alluvial to marine shoreline deposits.

Unit W: A thick unit of marine sands underlies the point bar deposits described above, is characterized by the Textularia W fauna, and commonly referred to as Text. W. These sands are generally fine to very fine-grained and were deposited as shore-parallel beach and offshore bars. They correlate well across the site area and vary from 300 feet to nearly 1000 feet. The sand is often mineralized with iron carbonate in steeply dipping areas adjacent to the dome with voids filled with salt as a result of concentrated downward percolation of brine.

Unit BH: Unit BH, or Bigenerina **humblei**, is a sequence of clays and sands where the clay members are thicker than the

sand. The clay may reach a thickness of 300 feet while the sand varies from thin stringers to 200 feet thick. The sequence of clays and sands forms oil traps in sand layers sealed against faults.

Unit CI: Deep water deltaic silts and clays characterized by upward crossing **foreset** beds have been mapped as unit CI or Cristellaria I. Shale interbeds increase toward the base of this unit. CI is the lowermost deltaic deposit in the **strati-**graphic sequence at Weeks Island.

Unit B5: The Boliviana 5 unit is a distinct sand which is approximately 30 to 150 feet thick. It is a marine delta type of sand deposit found between the massive CI and C0 sands.

Unit C0: A unit of sand 500 feet or more thick below unit CI has been designated C0 and is characterized by the fauna **Cibi-****cides** opima. These sands were deposited as delta-mouth and offshore bars; however, the typical structure of such deposits is somewhat obscured in this unit. Slumping and faulting of the sediments occurred shortly after deposition, obscuring the structure and making correlation on well logs difficult.

Unit AB: Amphistegina B or Unit AB is composed of marine clays containing abundant volcanic ash originating far to the west of the site in the areas of west Texas, New Mexico, and Arizona. The top of the unit is indicated by a thin layer of sand deposited as an offshore bar.

Unit R43: Below unit AB lies a strata of sand up to 1000 feet thick. This unit is generally used to define the uppermost unit of the lower Miocene and is composed of marine sands with

depositional structure associated with regressive (receding) seas. The basal 200 feet of this unit contains fine clay interbeds.

Unit OP: This unit consists of marine clays and shales containing large amounts of calcium carbonate (**CaCO₃**). The lower portion of this unit contains sands deposited as offshore bars. It is characterized by the Operculinoides fauna.

Unit CII: A unit of marine sands composed of two members, each approximately 200-300 feet thick, underlies unit OP. The sands are relatively well sorted, clean with no clay interbeds. Unit CII is characterized by the Cristellaria II fauna.

Unit CA: Cibicides A, or Unit CA, is composed of individual clean sand layers up to 30 feet thick. Their depositional structure represents marine offshore bar deposits.

Unit MA: This unit is made up of fine sands showing **depositional** structure of deep water **foreset** delta beds. Individual lenses are 10 feet or less thick and the overall deposit is nearly 400 feet thick. The biostratigraphic zone of this unit is that of Marginulina ascensionis.

Unit SD: Sands which were deposited into the Anahuac clay by turbidity currents are designated Unit SD for the fauna **Siphonina davisii**. These sands are intermixed with the clays in thick lenses which contain relatively fresh or brackish water (**10-12%** salinity) which makes the unit easily identifiable on the geophysical resistivity logs.

Unit PP: This unit of turbidite sands below Unit SD is composed of lenses 10 to 30 feet thick forming a total thickness

of approximately 500 feet thick. The unit is similar to Unit SD and is characterized by the fauna *Planulina palmerae*.

Unit LB: The deepest unit encountered in drilling in the Weeks Island area is Unit LB marked by the fauna *Liebusella*. This unit represents the bottom of the Miocene sequence of deposits in the area. It is similar in composition and depositional environment to Units SD and PP.

Unit Pr: A diapiric shale sheath is found at the Weeks Island dome on the southwest side where it is present at a depth of approximately 8000 feet. On the north side, there is some indication of the shale sheath under the salt overhang where deeper beds have been deformed upwards along the salt stock. Where present, this sheath forms an excellent impervious barrier to the salt stock.

5.3 - Structure Around the Dome

Weeks Island is the central island of the Five Island Chain of salt domes in Louisiana (Figure 2.1). This chain of salt domes follows a large NW-SE trending growth fault along which the deeply buried bedded salt has migrated in an upward direction. The salt has risen through the thick accumulation of sediments described in the previous section. Growth faults, which are common in the Gulf Coast sediments, are caused by the differential subsidence of the Gulf Coast geosyncline. They are faults which form contemporaneously and continuously with deposition, thereby the offset or throw of the fault increases with depth and the strata on the down-throw side are thicker than the correlation strata of the upstream side.

Salt responds plastically under high temperature and pressure conditions. When the specific gravity of the materials

surrounding the salt exceeds that of salt, the salt becomes "buoyant" and starts an upward migration through the overlying material. In this area of the Gulf Coast, such upward movement commences at a depth of between 8,000 and 12,000 feet. As with all types of piercement structures, the dome must displace the overlying sediments as they are intruded, dragging the adjacent sediments upward along the edge of the dome. As uplift proceeds, sediments deposited over the top of the dome must be either pushed aside or eroded away. In some instances, the more massive sands are often broken by the intrusion of the salt thereby showing little upward flexure near the edge of the dome. In other cases, however, a layer of sand or shale may be deflected from near horizontal to an angle of up to 60 degrees by the upward movement of the salt.

On a dome like Weeks Island, as each layer of sediment is deposited over the dome, the upward movement of the salt stretches it to the point of failure, essentially pulling the layer apart in a series of normal faults. The mechanical failure of the sediments surrounding the dome causes faults to develop radially from and tangentially to the dome in a series of **"horst-graben"** structures.

Once a fault has formed, it continues to grow as additional sedimentary layers are deposited and the dome continues to rise; therefore the fault offset decreases upward along the fault planes. Although the displacement of some of these **dome-**related faults is on the order of hundreds of feet at the dome edge, displacement decreases and faults die out rapidly away from the dome, generally within less than a mile. The faults are observed to flatten in the deep muds from a dip of 60 degrees in dry sand to 35 degrees in the litho-pressured clays.

Four major faults have been identified in association with the growth of the Weeks Island dome. These have been designated **F1** through **F4** and are discussed later in this section. The dips of these fault planes are principally controlled by the **lithology**, with the more consolidated sediments rupturing at a higher fault angle than the less consolidated materials.

Details of the relationships of the faults and strata to the salt intrusion are indicated in detail on the structure maps of the various units, Figures 5.6 through 5.12, and in the cross sections through the dome, Figures 5.14 through 5.21. The locations of the cross sections are shown on Figure 5.13. The apparent irregularities in the dip of the faults on several of the cross sections is due to projection of well data onto a line of section off-parallel to the fault plane.

Structure maps have been prepared for the top of the:

- **Alton** Sand and Gravel (A);
- Peorian Clay (P);
- Pliocene (TP);
- Miocene (MIO);
- Clay marker within Textularia L (2L);
- Bigenerina 2 (2); and
- Textularia W (W).

These maps are presented on Figures 5.6 through 5.12 and are discussed below. Reference should be made to Figure 5.1 and Table C.3 for the specific well locations and stratigraphic depths. These stratigraphic horizons have been mapped because of their continuity throughout the area and their distinct identification on the electric well logs. These maps have been

prepared to assist in defining the salt dome geometry and structures within the sediments around the dome. By relating these structures to known and potential anomalies within the dome, better understanding of salt dome tectonics and future planning of dome activities are possible.

Alton (A): The **Alton** structure map is made on the shallowest (youngest) continuous mappable horizon over the top of the dome (Figure 5.6). The **Alton** is cut by all four of the identified faults (**F1** through F4). The contours of the top of the **Alton** clearly show the smooth parabolic doming of the salt stock.

Peorian Clay (P): The Peorian clay mapped horizon corresponds with the deep mine levels (Figure 5.7). As noted from the map, uplift of the Peorian clay to the edge of the salt is up to 400 feet. Three major faults have been mapped as intersecting this horizon (**F1**, F2, and F3). However, due to the relatively shallow depths of these faults, offsets are generally less than 50-100 feet.

Pliocene (TP): The structure map of the top of the Pliocene (Figure 5.8) illustrates the full size of the Weeks Island salt dome. The mapped horizon ranges from a depth of more than 2800 feet in the rim **syncline** to the north of the dome to 2500 feet along the western edge of the salt. Faults **F1**, F2, and F3 also intersect this horizon with offsets ranging up to 150 feet across F3. Fault F3 projects beneath the salt dome overhang on the north side of the dome.

Miocene (MIO): The shape of the dome at this horizon (Figure 5.9) is similar to that mapped for the Pliocene. There is over 700 feet of upward drag of the Miocene along the salt edge.

The rim **syncline** is clearly shown north of the dome. Fault offsets have increased with depth, reaching several hundred feet across Fault **F1**.

Clay Marker within Textularia L (2L): The structure map on top of the marine clays of the Textularia L clearly show the plastic behavior of this unit which exhibits more than 1500 feet of uplift along the salt edge (Figure 5.10). This unit appears more faulted due to the decreased competence of the clay. Fault offsets across some of the major structures (**F1** and F2) exceed 1000 feet.

Bigenerina 2 (2): The Bigenerina 2 structure map (Figure 5.11) provides similarities with the overlying Textularia L structure. Sediment uplift along the edge of the dome exceeds 2000 feet.

Textularia W: The Textularia W unit (Figure 5.12) is the thickest sand in the entire section and is isolated by thick marine shales. Mineralization of this unit is evident along the northwest quadrant of the dome.

The edge of the salt dome has been drawn to the "best fit" of the data on the radial sections Figures 5.14 through 5.17. Shown on the sections are the key stratigraphic units (Sections 4.3 and 5.2) as identified in the individual well logs. Several of these marker horizons have been correlated to demonstrate the surrounding stratigraphic relationships with the salt dome. Symbols which appear to be misaligned may be the result of faulting and/or distance of projecting the well log data to the section line.

Faults and their displacements, where identified in the logs, are also shown on the sections (i.e., F350). The major faults which have been identified and shown on the figures are discussed below.

Fault F1: Fault **F1** is the main regional growth fault which strikes NW-SE, intersecting all of the Five Island salt domes. **F1** is readily identifiable on all the major structural horizons (Figures 5.6 through 5.12) and constitutes the most significant structure around the Weeks Island dome. The fault is normal, dipping to the NE with more than 1,100 feet of vertical displacement at a depth of **10,000-11,000** feet. Mapping of sequentially shallower structural horizons shows the fault trace of **F1** to move "up-dip", thereby assuming a more WNW-ESE direction (Figures **5.6** through 5.12). The fault has up to 50 feet of displacement in the overlying **Alton** Sand. Correlation of this feature with structures within the dome is discussed in Section 5.5.

Fault F2: Fault F2 appears to be another major fault intersecting the dome in a NNE-SSW direction. The actual relationship between the mapped F2 fault on the northeast and the F2 fault on the southwest portions of the dome are unclear. No F2 fault has been shown on the structure maps in the northwest between the Peorian and the Textularia L horizons (Figures 5.8 and 5.9). Correlation was extremely difficult in this area due to the massively thick sands within the sections. There may possibly be two separate faults (deep and shallow) in this quadrant of the dome which coincidentally overlie each other.

For the purpose of simplicity, this fault(s) has been given the designation F2.

The fault dips to the east, with more than 1000 feet of vertical displacement on the Textularia W horizon (Figure 5.12) decreasing to less than 50 feet of displacement on the Peorian Clay (Figure 5.7). F2 fault has been correlated with the normal fault mapped in the sediments southwest of the dome (Figures 5.7 through 5.12).

Fault F3: Fault F3 has been mapped as a tangential fault striking roughly WNW-ESE. F3, which projects beneath the salt overhang along the northern edge of the dome, dips towards the north with a maximum vertical displacement of up to 500 feet.

Fault F4: Fault F4 appears to be a relatively minor fault which strikes nearly N-S across the top of the dome (Figure 5.6). Evidence for this structure has been based on structural mapping on the **Alton** Sand, surface mapping and topography, and mapping structures within the dome.

These faults and their relationship to the dome structures are discussed in Section 5.5. These structures are essentially the same as those found by Atwater and **Forman** (1959). This study agrees with Atwater and **Forman's** interpretation of the number and strike of the faults on the west side of the dome where well control is good; however, more recent drilling has led to a different interpretation of the strikes of the faults on the east side of the dome.

5.4 - Dome Geometry

(a) General

The geometry of the dome plays a significant role in the integrity of the SPR. The location of the SPR mine with respect to the edge of the dome, the top of the salt, and

any structures within the salt, to a large degree determines the containment potential and stability of the mine. Therefore, significant emphasis has been placed on determining the boundaries of the dome and structures within the dome.

(b) Top-of-Salt

The top of the salt dome is controlled primarily by **solu-**tioning of the salt and, to a limited degree, fault control. The contours of the top of the salt stock are shown on Figures 5.22 and 5.23. There is essentially no **caprock** over the Weeks Island salt stock. Only small, thin patches of gypsum are present near the outer edges, but elsewhere, clay, sand and gravel lie directly on the relatively flat dome surface (Figures 4.2 through 4.5). Therefore, since there is no protective **caprock** or impervious clay layer, fresh ground water is able to actively shape the upper surface of the salt mass. The topography of the top of the Weeks Island salt dome is thus largely determined by the intensity and direction of the ground water flow within the sediments in contact with the salt.

Due to the permeable nature of the surficial sediments, surface topography has little effect on the direction of flow of ground water, other than creating a general flow radially outward from the center of the island. The rate of dissolution depends upon surface water infiltration into the overlying sediments and the ground water gradient and conductivity.

Interpretation of the shape of the top of the dome, based on available data, is shown on the various cross sections presented in Figures 4.3 through 4.5 and 5.14 through 5.21.

The topography of the top of the dome was compiled using all available data from borings drilled on the dome. Locations of these borings are shown on Figures 5.1 through 5.4 and in Appendix C. The top-of-salt contours shown on Figures 5.22 and 5.23 are based on these borings, surface contacts extrapolated to the top-of-salt, and projected faults from surface and subsurface data.

Where drilled, the top surface of the salt was found to be highly fractured with major loss of circulation (Acres, 1986 and Fenix & Scisson, 1979a, b, c). The interpreted topography of the top of the salt dome suggests a small salt ridge trending NE-SW under the DOE site in the area of the SPR shafts (Figure 5.24). Valleys on top of the dome appear to be the result of preferential ground water solutioning which could occur along shear zones within the salt mass (see Section 5.5). Although Kupfer (personal communication) postulates that these zones of depression could extend as much as 200 feet into the salt, no evidence was found to show more than approximately 50 feet of differential solutioning (Figure 5.23). The valleys in the salt along the south side of the dome may be associated with differential solutioning along shear zones parallel to the extension of the main growth fault F1 extending into the salt (see Section 5.5).

(c) Edge of the Salt

The location and configuration of the edge of the salt was determined using information from oil and gas wells which either penetrated the salt or were located adjacent to the dome. In areas close to the dome where sediments have been deflected steeply upward, a few of the thickest sands (in particular Unit W) are mineralized with a salt

matrix as a result of percolation of saturated brine through the formation. In addition, lithification of clays to shales is also very evident close to the salt. Both of these characteristics are quite distinct on the geophysical logs and have therefore been used in interpreting the edge of the dome. In addition, data from approximately 50 wells which penetrated the salt were used to define the salt boundary. Utilizing these data, four tangential sections were generated off the dome to assist in defining the salt edge (Figures 5.18 through 5.21).

The configuration of the edges of the salt stock are shown by the contours of Figure 5.22 and are best illustrated in the cross sections of Figures 5.14 through 5.17. As shown on Figure 5.22, the salt forms a prismatic-shaped stock with sub-parallel edge boundaries in cross section, dipping approximately 80° from horizontal. The east side of the stock barrels-out into the sediments north of the main fault (**F1**), forming an overhang indicated by the dashed contours on Figure 5.22.

5.5 - Dome Structure

No previously known studies have been undertaken to relate structures within the surrounding sediments with those mapped within salt domes. As part of this study, an attempt was made to determine if there was any correlation between internal and external structures. The expression of faulting inside the salt is different than in the surrounding sediments.

The salt mass is rheologic in nature and through continuous movement, resembling flow, zones of stress relief tend to become contorted and twisted as they partially heal themselves.

As a result, while stress in the sediments surrounding the dome is relieved along narrow planes which can be classified as faults, the expression of these features inside the dome is in the form of zones of disturbed, impure salt.

It has been postulated that salt dome emplacement occurred as a series of differentially moving salt spines. Compression and squeezing of the salt mass occurred as the salt spines moved upward through the sediments. Boundaries between these salt spines are called "shear zones" or anomalous zones and are characterized by impure salt, pressure pockets, inclusions, and highly deformed salt (Kupfer, 1977). The upward movement of these salt spines resulted in rupturing and faulting of the overlying sediments. . Therefore, the shear zones mapped within the dome should be correlative with external fault structures. As the dome continued to move upward, these faults extend and expand upward around the dome. Since these faults dip at varying angles, their structural traces rotate "up-dip" as shallower horizons are mapped. Therefore, to correlate external structures with internal structures requires an understanding of the time-history of dome emplacement which makes interpretation and correlation extremely complex. To further complicate interpretation, the dome may have rotated during emplacement, thereby causing realignment of the interior structures relative to the exterior structures.

The salt structures within the various mined levels have been mapped in detail by Dr. Kupfer (Acres, 1977 and Kupfer, unpublished). A summation of these principal structural features identified within the dome are presented below and shown on Figure 5.25.

A postulated correlation of the external structures as shown in plan on Figures 5.6 through 5.12, and in profile on Figures 5.13 through 5.21, with the internal structure features shown on Figure 5.25 are:

<u>External</u>	<u>Internal</u>
F1	Shear Zone A
F2	Shear Zone B
F3	None
F4	Shear Zone D
Unknown	Shear Zone E

Zone A: Zone A appears to be an alignment of gas outbursts encountered during mining in both the lower level of the DOE SPR mine and the new Morton Mine workings. Dr. Kupfer (personal communication, 1987) found this zone peculiar in that it cuts across bedding at almost right angles in places, whereas all the other zones either parallel bedding, or drag bedding into parallelism. The Morton Mine is currently penetrating this zone and blowouts, sandstone stringers, impure salt, and areas of high moisture have been encountered. Recently completed drilling in the Morton Mine has confirmed that this zone is about 150-200 feet wide.

Zone A appears to align with the previously mapped major NW-SE trending fault, **F1** at or below the Textularia W level (Figure 5.12). Fault **F1** is a major regional structure which has, at least in part, controlled the emplacement of the Five Island salt domes. The fault has over 1000 feet of displacement at a depth of 7,000-10,000 feet (see Section 5.3). Therefore, based on in-mine mapping and recent exploration, it is postulated that Zone A is a manifestation of that fault into the salt dome and constitutes a major structure within the dome.

Zone B: Zone B is a structural feature which has been projected between the DOE SPR mine and the Morton/Markel Mines. Although mapping of the Markel drifts, which cross this zone, has failed to show evidence of a "typical" shear zone, other geomorphic and geologic evidence tends to suggest the presence of some anomalous zone in this region. These include the "**wet**" drift and a pronounced valley in the top-of-salt (Figure 5.23). This shear zone may be structurally related to F2 (Section 5.4); however, lack of geologic control on the north side of the dome makes this projection tentative.

Zone C: Zone C has been mapped by Dr. Kupfer on the west side of the north part of the lower level of the SPR mine (Acres, 1977). The zone appears to die out southward into good, **normal-grained**, pure salt. It contains numerous outbursts, liquid hydrocarbons, a sand stringer, and much pegmatite-like coarse-**grained** salt. Portions of the east working of the **1200-foot** new Morton Mine level workings may be in the western edge of this zone. Outbursts occur along a 50-foot long zone, and coarse-grained salt extends for 500 feet. The relationship of this zone with Zone B is not clear.

Zone D: Shear Zone D has been identified since the 1970s (Acres, 1977). It borders the eastern edge of the lower level of the DOE oil storage area and controlled the configuration of the mine along this side of the dome. The zone contains such typical features as clay, sand, oil, grease, moisture and extensive "black" or impure salt. Outbursts occurred at the north end of this zone. Mining activity did not penetrate through this zone. The west edge of the zone grades into coarse-**grained** salt and then sheared salt. The zone has a very marked surface topographic expression with the Devil's Backbone ridge

to the west and the low valley and ponds to the east (Figure 2.2). Dr. Kupfer (1977) has interpreted this zone as the boundary zone between two spines of salt movement. Although this zone appears to align with F4 (Figure 5.6), F4 is a relatively minor fault (Section 5.3) whose alignment may be only coincidental with Zone D.

Zone E: The southern Zone E is highly sheared with the beds dragged into parallelism with the edge of the salt stock. Gas outbursts are evident. Top-of-salt appears to be highly modified in this region (Figures 5.22 and 5.23). This zone does not appear to be correlative with any mapped structures outside of the dome.

Banding: This zone is up to 1000 feet wide (Figure 5.25). It is a folded mass of impure salt with dark beds, coarse-grain, high wetness and stringers of sandstone. The origin of this zone is highly speculative and could be just a mass of "dirty" primary salt dragged up some 30,000 feet.

5.6 - Domal Movement

The overall movement of the Weeks Island salt dome is generally in an upward direction. The rate of uplift of the top of the salt dome has been computed by dating the sediments over the top of the dome such as the **Alton** sand (80,000 years old) and dividing it into its total uplift (650 feet) in that period. This indicates a rate of uplift of 0.1 in/year (2.5 mm/yr). This relatively high rate of uplift likely accounts for the absence of a **caprock** and the high topographic expression of the island.

While the dome moves in an upward direction overall, there is also differential movement of salt within the dome. Man's **min-**ing activities within the dome have resulted in surface subsidence resulting from mine convergence at depth. The existing

subsidence data collected since 1983 are shown on Figure 5.26. Although the data are extremely limited and somewhat questionable, they do suggest that up to 0.8 feet of subsidence has occurred over the SPR facilities since 1983. DOE and Morton are currently preparing a detailed subsidence and convergence program for the Weeks Island dome to be initiated in 1987-88.

5.7 - Salt Properties

(a) Composition

Salt analyses were performed in 1977 on salt samples recovered from the lower SPR mine level and in 1979 from the upper level. Spectrographic analyses were performed on both pure and impure salt samples. Generally, there was little difference between **salt** from the upper level and that from the lower level. Salt purity was found to be high (>98.9 percent) with the major impurities being **Ca, S, K, Al, Fe, Si, and Sr**. The samples from the lower level generally contained more impurities, these being **Ca, P, K, Si, Al, Fe, and Sr**. Results are presented in Tables 5.2 and 5.3.

A petrographic analysis showed the Weeks Island salt to be generally coarse **grained**. Unlike samples from other salt domes, no small grains at the intersection or contact of larger grains were found. This lack of smaller grains may account for the observed friable nature of the Weeks Island salt, since with more uniform grain sizes the contact between the grains is minimized. Details of the petrographic analyses can be found in Acres (1977 and 1979).

(b) Salt Strength

Salt strength tests were performed on samples from the lower level in 1977 and for upper level samples in 1979 (Acres, 1977, 1979). The 1977 test results showed:

- Indirect Tensile Strength
 (Average of **9** tests) = 155 psi
 Unconfined compressive (uniaxial) strength
 (average of 4 tests on 6-inch diameter
 specimens) = 2,020 psi

- Triaxial Compressive Strength
 at 500 psi confining stress based
 on average of 3 tests on NX
 (**2-7/8-inch** diameter) specimens = 7,100 psi

- Mohr-Coulomb Strength envelope
 in the form $T = C + \sigma \tan \phi$ is given by
 $T = 330 + \sigma \tan 56^\circ$ (psi)
 where T and σ are the shear and
 normal stresses respectively
 associated with the plane of failure.

The results of the 1977 tests showed unconfined strength of the salt to be significantly less than that measured for salt from other domes. This lower strength was largely attributed to the lack of intercrystalline bonding or cohesion. This was supported by the fact that core samples tend to readily deteriorate. Disaggregation of the samples along the weak grain boundaries was probably the result of stress relief. It was for this reason that

the laboratory unconfined strength tests were not considered indicative of the actual in situ salt strength. As a result, the tests performed in 1979 were directed at more accurately defining the in situ strengths of the salt.

In the 1979 program for the upper level, 19 large diameter (4-inch and 6-inch) samples were tested to obtain more consistent and representative salt strengths (Acres, 1979). These test results, which are presented in Table 5.4, were very consistent, ranging between a maximum value of 2975 psi to a minimum value of 2330 psi, with a mean value of 2660 psi.

Unconfined and triaxial compression tests were also carried out on NX (2-inch diameter) cores. The unconfined strengths were much lower and more erratic than those from the larger samples, primarily due to the large-sized crystals.

Triaxial compression tests at 500 psi confining pressure resulted in a range of compressive strength values from 3000 to 5660 psi, with an average value of 4448 psi, while tests at 1000 psi confining pressure resulted in values ranging from 3850 to 5690 psi with an average value of 4878 psi. Young's modulus for all tests ranged from 1×10^4 psi to 4.8×10^5 psi and Poisson's ratio ranged from 0.19 to 0.47. Owing to the very high grain-diameter to sample-diameter ratio of certain samples (0.3-0.5 inch crystals in 2-inch diameter samples), reliable strain measurements could not be obtained. Results of these tests are presented in Table 5.5.

Tensile strength tests performed on 2-inch diameter samples gave strength values ranging from 20 to 49 psi (Table 5.6).

(c) Permeability Tests

In 1977, field permeability tests were performed in **bore-**holes drilled into the salt in the lower level and samples taken for laboratory testing. The upper level was not accessible for drilling equipment at that time, but a series of field tests were conducted in the upper level during the final stages of conversion to oil storage in 1979 and samples taken for laboratory testing. Details of the locations, test procedures and results of those testing programs are given in published reports (Acres, 1977 and 1979).

The 1977 field tests were conducted using diesel fuel in a series of NX boreholes at four sites around the perimeter of the lower level. No measurable continuous inflow was recorded during 148 of the total 155 tests performed with a 5-foot test length and test pressures up to 60 psi. It was concluded that the in situ permeability was in all cases less than 0.02 millidarcys (md).

Laboratory tests on NX core recovered from the boreholes in the lower level were carried out using both nitrogen and diesel fuel as the test fluid at confining pressures of 200, 500 and 1000 psi. Test results are presented in Table 5.7 and indicate significant reductions in permeability with increasing confining pressure. Under 200 psi confining pressure, the permeability ranged up to 366 md for nitrogen and to 125 md for diesel fuel; under 1000 **psi**, the ranges were up to 20 md and 12 md for nitrogen and diesel fuel respectively.

These relatively high laboratory values were not consistent with the permeabilities calculated by the field testing. Detailed analyses of the samples showed them to be disturbed and therefore not representative of actual in situ conditions.

In situ permeability testing was undertaken in the upper level in 1979. The results of 15 tests run with nitrogen ranged from 0.0055 to less than 0.0001 md, while the tests run with diesel fuel gave results ranging from 0.015 to 0.0001 md (Table 5.8).

The results of laboratory permeability tests undertaken in 1979 were comparable to those done in 1977, where the measured permeabilities were two to three orders of magnitude higher than that measured in the field. Tests with air gave values up to 340 md at 200 psi confining pressure and up to 14 md at 1000 psi pressure: comparable results for tests with diesel fuel were 276 md and 3.7 md (Table 5.9). Again, this high variance was attributed to sample disturbance. It is highly probable that the salt cores underwent stress relief following drilling, which resulted in intergranular loosening between salt crystals, giving rise to an increase in the effective permeability of the samples. Hence, the results of the field permeability tests were again considered to be more closely representative of the true permeability of the salt mass.

In summary, the field permeability testing carried out in the lower level in 1977 and the upper level in 1976 indicated that the mass permeability of the salt in both levels was less than 0.02 md.

TABLE 5.1

PLEISTOCENE, PLIOCENE AND MIOCENE STRATIGRAPHY

<u>AGE</u>	<u>BIOSTRATIGRAPHIC ZONE</u>	<u>SYMBOL</u>	<u>DEPOSITIONAL ENVIRONMENT</u>
Pleistocene	Cary Sand	cs	Deltaic sand of glacial outwash origin
	Cary Clay	cc	Bay and marsh clay
	Wisconsin Sand	WI	Deltaic sand
	Two Creeks Clay	2c	Marsh to marine clay
	Alton Sand and Gravel	A	Alluvial-deltaic sand and gravel
	Sangamon Clay	S	Marine clay
	Illinoian Sand	I	Alluvial-deltaic sand and gravel
	Peorian Clay	P	Marine Clay
	Kansan Sand	KA	Deltaic and marine sand
	Nebraskan Sand	NE	Alluvial-deltaic sand and gravel
Pliocene	Buliminella	TP	Alluvial clay and thin sand
	Middle Pliocene	MP	Alluvial gravelly point bar
Miocene	Bigenerina	MIO	Alluvial topset beds - stacked point bars
	Textularia L	L	Alluvial point bar sands
	Clay Marker	2L	Shallowest marine clay
	Bigenerina 2	2	Thick marine clay
	Textularia W	W	Thick marine sands
	Bigenerina humblei	BH	Shallowest clay thicker than sand-main oil trap
	Cristellaria I	CI	Deeper water foreset beds
	Bolivina 5	B5	Thin marine sand
	Cibicides opima	co	Delta-mouth bar or marine channel sand
	Amphistegina B	AB	Marine clay
	Robulus 43 (lower)	R43	Marine clay
	Operculinoides	OP	Limy marine clay
	Cristellaria II	CII	Marine channel sand
	Cibicides A	CA	Marine channel sand
	Marginulina ascensionsis	MA	Deepest thick sand-offshore bar
	Siphonina davisii	SD	Turbidite sands in Anahuac deep water clays
	Planulina palmerae	PP	Thin turbidite sand
	Liebusella	LB	Thin turbidite sand marker near base of miocene

ADDITIONAL MAP SYMBOLS

TL	Top of Log
TS	Top of Salt
BS	Bottom of Salt
MN	Mineralized Sand
Pr	Overpressured Shale
GY	Gypsum
CL	Clay
SA	Sand
SG	Sand and Gravel
F200	Fault with 200 ft Throw
TD	Total Depth of Well

TABLE 5.2
WEEKS ISLAND MINE
ELEMENTAL ANALYSIS OF ROCK SALT
UPPER LEVEL

Element	Sample Location and Results*				
	VBPd	B9	M4	R10	115
Na	390,000	389,000	390,000	390,000	390,000
Cl	605,000	600,000	605,000	601,000	605,000
Al	22	20	5	5	68
Be	<0.05	<0.05	<0.05	<0.05	co.05
Ca	2,360	3,730	2,570	2,150	4,620
Cr	<1	<1	1.5	1.4	<1
cu	1.6	1.6	1.4	1.9	1.1
Fe	14	<1	<1	37.5	35
Mg	<1	<1	<1	<1	<1
Mn	<1	<1	1.4	2.4	3.9
P	<5	<5	<5	<5	<5
K	360	360	600	660	100
Pb	<5	<5	<5	<5	<5
Zn	<5	<5	<5	<5	<5
Ba	0.7	0.5	0.5	0.5	3.5
Si	32.5	16	11	11	16
Ag	1	1	1.3	2	0.5
Sr	8	12	8	7	14
Ti	3	<0.5	<0.5	<0.5	3
V	1.2	1.2	0.4	0.4	0.6
B	1.9	1.0	0.7	1.5	3.8
co	15	18	11	18	5
S	1,600	1,700	1,600	1,600	1,600

* All results are given in ppm by weight. Analysis by atomic absorption spectrometer.

Source: Acres, 1979

TABLE 5.3

WEEKS ISLAND MINE

ELEMENTAL ANALYSIS OF ROCK SALT
LONER LEVEL

Sample Location	Na %	Cl %	Al	Be	Ca	Cr	cu	Fe	Mg	Mn	P	K
H23**	1.12	1.69	45,000	1.9	89,600	124	23.8	19,900	50,000	368	400	3,900
H23	38	58	23.9	<0.2	3,900	0.78	2.59	33.6	<0.2	0.36	130	500
w14	42	58	58.4	<0.2	4,910	3.28	2.07	33.6	<0.2	0.84	110	50
Al	42	57	37.2	<0.2	4,860	4.72	9.63	70.5	co.2	1.40	80	50
K3	41	58	15.9	<0.2	262	0.59	2.20	36.9	<0.2	0.05	90	50

Pb	Zn	Ba	Si	Ag	Sr	Ti	V	B	co	S
215	52	174	1,170	<0.1	56.2	2,380	117	24	17.5	0.26
5	0.3	2.9	40.5	co.1	10.0	1.45	0.01	*	0.3	0.33
4	0.3	4.3	40.8	<0.1	15.3	4.58	0.05	*	0.3	0.35
37	0.9	2.4	41.0	<0.1	17.6	6.18	0.04	*	0.9	0.34
6	0.1	0.2	22.1	co.1	8.48	1.11	0.01	*	0.1	0.02

1 All results are given in PPM by weight unless otherwise indicated. Analysis by a chemical frame spectrometer.

* No Test performed

** Sample of carbonaceous shale

Source: Acres, 1977

TABLE 5.4

WEEKS ISLAND MINE

SUMMARY OF UNCONFINED COMPRESSION
STRENGTH TESTS ON LARGE DIAMETER CORES
UPPER LEVEL

<u>Site</u>	<u>Sample No.</u>	<u>Sample Diameter (in.)</u>		<u>sample Length (in.)</u>	<u>Lab Sample No.</u>	<u>Unconfined Compressive Strength* (psi)</u>	<u>Site Average Strength (psi)</u>
		<u>Nominal</u>	<u>Actual</u>				
B9	B9-41-1	4	3.625	6.88	7	2765	B9 2620
	B9-42-1A	4	3.625	8.25	13	2530	
	B9-42-1B	4	3.625	4.95	1	2715	
	B9-43-1A	4	3.625	7.63	16	2420	
	B9-43-1B	4	3.625	8.00	2	2385	
	B9-61-1	6	5.750	7.00	9	2610	
	B9-61-2	6	5.750	6.81	4	2870	
	B9-62-1	6	5.750	5.94	11	2665	
M4	M4-41-1	4	3.625	7.31	14	2910	M4 2765
	M4-2-1A	4	3.625	6.75	19	2975 (max)	
	M4-42-1B	4	3.625	8.25	20	2570	
	M4-43-1	4	3.625	7.38	15	2600	
R10	R10-61-1	6	5.750	6.23	3	2835	R10 2780
	R10-42-1	4	3.625	7.25	8	2600	
	R10-41-1	4	3.625	7.13	12	2910	
	R10-51-1	Broke before sawing - poor sample			18		
115	115-41-1	4	3.625	8.14	10	2330 (min)	115 2485
	115-42-1	4	3.625	7.30	5	2640	
Upper Vent Bypass	VBPD-41-1	4	3.625	8.25	6	2630	VBPD 2575
Drift	VBPD-42-1	4	3.625	8.38	17	2520	_____
AVERAGE STRENGTHS						2660	2645

* Corrected for length/diameter ratio in accordance with ASTM Designation C-42. All cylindrical core cut from floor of mine with axis vertical, April 1979.

Source: Acres, 1979

TABLE 5.5

WEEKS ISLAND MINE

SUMMARY OF UNCONFINED AND TRIAXIAL COMPRESSION TEST
RESULTS ON NX-SIZE SALT CORES
UPPER LEVEL

Sample Number	Borehole Number	Confining Pressure (σ_3) psi	Maximum Stress Difference ($\sigma_1 - \sigma_3$) psi	Young's Modulus* (psi)	Poisson's Ratio
S1	I15-H1	0	2220	1.09×10^5	**
s3	I15-H1	0	255	5.0×10^4	**
S5	115-11	0	940	6.0×10^4	0.37
S9	115-11	0	270	1.3×10^5	**
S11	B9-H1	0	960	9.4×10^4	0.44
S23	M4-H1	0	120	**	**
s37	R10-I1	0	1590	9.9×10^4	**
s39	R10-I1	0	725	4.3×10^5	0.47
s47	VBPD-H1	0	435	**	**
***		0	1250	1.1×10^4	0.35
S7	115-11	500	5000	1.7×10^5	0.46
s21	M4-H1	500	4840	4.3×10^5	0.27
s35	R10-I1	500	3740	2.1×10^5	**
s49	VBPD-H1	500	5660	1.5×10^5	**
S41	VBPD-H1	500	3000	2.0×10^5	**
S15	B9-H1	1000	5180	1.2×10^5	0.35
S17	B9-I1	1000	3850	2.1×10^5	0.19
s29	M4-I1	1000	5690	2.1×10^5	0.46
s31	R10-H1	1000	5290	1.7×10^5	0.20
s43	VBPD-H1	1000	4380	4.8×10^5	**

* Tangent modulus at 50% of maximum load.

** Due to the very high grain-diameter-to-sample-diameter ratio of these specimens, reliable measurements of transverse and/or axial strains were virtually impossible to obtain. Hence, reasonable values of these parameters could not be defined.

*** Sample could not be positively identified.

Source: Acres, 1979

TABLE 5.6

WEEKS ISLAND MINE

SUMMARY OF TENSILE STRENGTH TESTS

UPPER LEVEL

Site	<u>Sample Number</u>	<u>Tensile Strength</u> (psi)
115-11	9	49
115-11	9	20
VBPD-H1	45	35
VBPD-H1	45	40

Notes: All samples 2.0 inches in diameter by 0.75 inches long. The failure plane propagated along grain boundaries causing the sample to crumble to failure.

Source : Acres, 1979

TABLE 5.7

SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS
LOWER LEVEL

Site	Hole Number	Sample Number	Depth Into Borehole (ft)	Permeability, Millidarcys		Confining Pressure (psi)
				Nitrogen	Diesel Oil	
A1	NX1	1	7	366		200
				103	Sample	500
				11	Failed	1,000
A1	NX1	2	10	83	21	200
				15	17	500
				1.3	7.4	1,000
w14	NX1	4	17.5	217	4.6	200
				44	3.1	500
				20	1.4	1,000
w14	NX1	5	45.5	35	20	200
				8.0	18	500
				1.2	8.4	1,000
w14	NX2	6	16	162	125	200
				56	63	500
				1.7	12	1,000
w14	NX2	7	19	106	19	200
				61	12	500
				8.3	4.6	1,000
w14	NX2	8	38	5.8	17	200
				3.7	10	500
				1.4	3.4	1,000
H23	NX2	10	42.5	40	1.3	200
				10	.67	500
				4.5	.28	1,000

Source: Acres 1977

TABLE 5.7

SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS
 LOWER LEVEL
 (Cont'd)

<u>Site</u>	<u>Hole Number</u>	<u>Sample Number</u>	<u>Depth Into Borehole (ft)</u>	<u>Permeability, Nitrogen</u>	<u>Millidarcys Diesel Oil</u>	<u>Confining Pressure (psi)</u>
H23	NX2	11	44	72 18 2.4	4.0 2.5 1.0	200 500 1,000
H23	NX2	12	49	26 11 2.6	5.0 3.1 1.1	200 500 1,000
H23		13	Block	0.001 0.001 0.001	0.0002 0.0001 0.0001	200 500 1,000
H23		14	Block	0.001 0.001 0.001	0.0001 0.0001 0.0001	200 500 1,000
S20		16	Block	0.42 0.06 0.04	0.018 0.013 0.009	200 500 1,000
S20		17	Block	0.36 0.12 0.08	0.09 0.07 0.05	200 500 1,000

Source: Acres 1977

TABLE 5.8

SUMMARY OF FIELD PERMEABILITY TEST RESULTS
UPPER LEVEL

TESTS WITH NITROGEN

<u>Site</u>	<u>Hole No.</u>	<u>Test No.</u>	<u>Test Pres. (Po) (psi)</u>	<u>Packer Pres. (psi)</u>	<u>Test Interval</u>		<u>Test Length (ft)</u>	<u>Measured Pressure Drop (psi)</u>	<u>Permeability of Test Millidarcys</u>	<u>Duration of Test (min)</u>	<u>Comments</u>
B9	H1	1	20	150	10.0	40.0	30.0	0.4	.0031	55	
B9	H1	2A	50	160	30.0	40.0	10.0	0.3	.0004	40	
B9	I1	1	20	160	10.0	40.0	30.0	0.0	<.0001	90)	No measurable pressure drop
B9	I1	2	40	160	25.0	40.0	15.0	0.0	<.0001	60)	
M4	H1	1	25	100	15.0	36.5	21.5	0.4	.0010	50	
R10	H1	1	75	160	30.0	40.0	10.0	0.6	.0030	5	
R10	I1	2	75	160	30.0	40.0	10.0	0.1	.0012	2	
R10	I1	4	25	160	15.0	40.5	25.5	0.1	.0055	5	
115	H1	4	25	160	14.5	40.0	25.5	0.1	.0055	5)	Packer apparently leaking but test section pressure not affected
115	I1	1	75	160	29.0	40.0	11.0	0.1	.0055	5)	
VBPB	H1	1	25	160	15.0	36.0	21.0	0.0	<.0001	90	No measurable pressure drop
VBPB	H1	2	60	173	25.0	36.0	11.0	16.0	--	25)	Apparent leakage;
VBPB	H1	2A	60	173	25.0	36.0	11.0	24.3	--	40)	Data not valid

Tests carried out in the upper level of the Weeks Island salt mine during April 1979.

Source: Acres, 1979

TABLE 5.8

SUMMARY OF FIELD PERMEABILITY TEST RESULTS
UPPER LEVEL
(Cont'd)

TESTS WITH DIESEL FUEL

<u>Site</u>	<u>Hole No.</u>	<u>Test No.</u>	<u>Test Pres. (Po) (psi)</u>	<u>Packer Pres. (psi)</u>	<u>Test Interval</u>		<u>Test Length (ft)</u>	<u>Stage 1</u>		<u>Stage 2</u>		<u>Stage 3</u>	
					<u>From (ft)</u>	<u>To (ft)</u>		<u>Perm. (md)</u>	<u>Time (min)</u>	<u>Perm. (md)</u>	<u>Time (min)</u>	<u>Penn. (md)</u>	<u>Time (min)</u>
B9	H1	1*	25	160	15.0	40.0	25.0	.0154	10	.0090	10	.0017	29
B9	H1	3	20	160	10.0	40.0	30.0	.0014	30	.0012	30	--	--
B9	I1	3	40	160	25.0	40.5	15.5	.0046	5	.0012	28	.0006	30
B9	I1	4	20	160	10.0	40.5	30.5	.0096	5	.0011	33	.0008	19
M4	H1	2	25	100	15.0	35.4	20.4	.0077	5	.0045	12	.0036	33
M4	H1	2*	25	130	15.0	36.5	21.5	.0008	28	.0003	29	--	--
M4	H1	2A	25	100	13.0	35.4	22.4	.0031	12	.0019	23	--	--
M4	I1	3*	28	134	15.0	40.0	25.0	--	--	.0001	30	--	--
M4	I1	4	75	140	30.0	40.0	10.0	.0006	30	--	--	--	--
R10	H1	5	25	160	15.0	40.5	25.5	.0011	35	.0001	30	--	--
R10	H1	8	75	175	30.0	40.5	10.5	.0031	30	.0019	32	.0017	28
R10	I1	6	25	160	15.0	40.5	25.5	.0018	32	.0007	33	--	--
R10	I1	7	75	160	30.0	40.5	10.5	.0013	32	.0004	30	--	--
115	H1	5	25	160	14.5	40.5	26.0	.0067	7	.0018	33	.0011	32
115	I1	2	75	160	29.0	40.5	11.5	.0022	17	.0014	18	.0006	32
115	I1	3	75	160	29.0	40.5	11.5	.0022	10	.0008	28	.0003	30
VBPD	H1	3	60	160	24.5	36.0	11.5	.0035	23	.0020	34	.0024	18
VBPD	H1	4	25	160	14.5	36.0	21.5	.0111	7	.0018	28	.0013	32

* Indicates Re-Test

NOTE: High pressure gas encountered during drilling of M4-H1.

Tests carried out in the upper level of the Weeks Island salt mine during April 1979

TABLE 5.9

SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS
UPPER LEVEL

TESTS WITH AIR

<u>Site</u>	<u>Sample Number</u>	<u>Permeability (millidarcys)</u>	<u>Confining Pressure (psi)</u>
I15-H1	2	127	200
		36	500
		5.0	1,000
115-11	6	159	200
		70	500
		<0.01	1,000
115-11	12	28	200
		11	500
		1.3	1,000
B9-H1	16	Failed	
M4-H1	22	43	200
		17	500
		3.1	1,000
M4-H1	26	26	200
		10	500
		1.8	1,000
		.62 @ 10 hrs	1,000
		.01 @ 72 hrs	1,000
		.18 @ 96 hrs	1,000
R-10-H1	32	335	200
		51	500
		2.6	1,000
R10-I1	36	341	200
		71	500
		6.0	1,000
VBPD-H1	42	183	200
		79	500
		14	1,000
VBPD-V1	50	44	200
		20	500
		2.2	1,000

Source: Acres, 1979

TABLE 5.9

SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS
UPPER LEVEL
(Cont'd)

TESTS WITH DIESEL FUEL

Site	Sample Number	Permeability (millidarcys)	Confining Pressure (psi)
I15-H1	4	Failed	
115-11	8	47	200
		18	500
		2.2	1,000
115-11	10	16	200
		7.7	500
		1.7	1,000
B9-H1	14	Failed	
B9-H1	18	29	200
		11	500
		2.3	1,000
M4-H1	24	48	200
		14	500
		2.8	1,000
M4-H1	28	12	200
		6.8	500
		2.2	1,000
R10-H1	34	3.7	200
		2.9	500
		2.1	1,000
R10-I1	38	276	200
		178	500
		Failed	1,000
VBPD-H1	44	18	200
		6.8	500
		3.7	1,000
VBPD-H1	48	Failed	

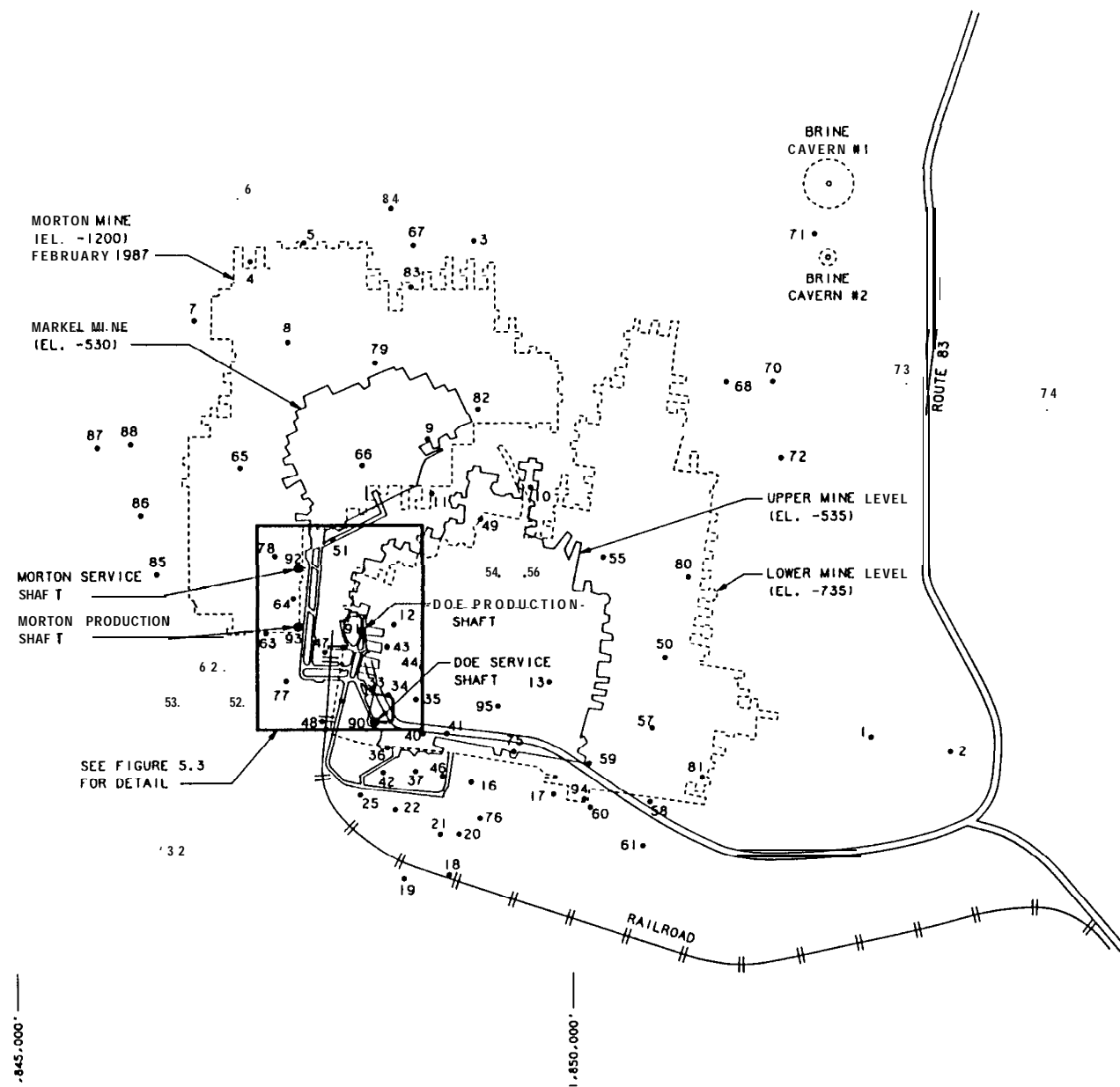
TABLE 5.9

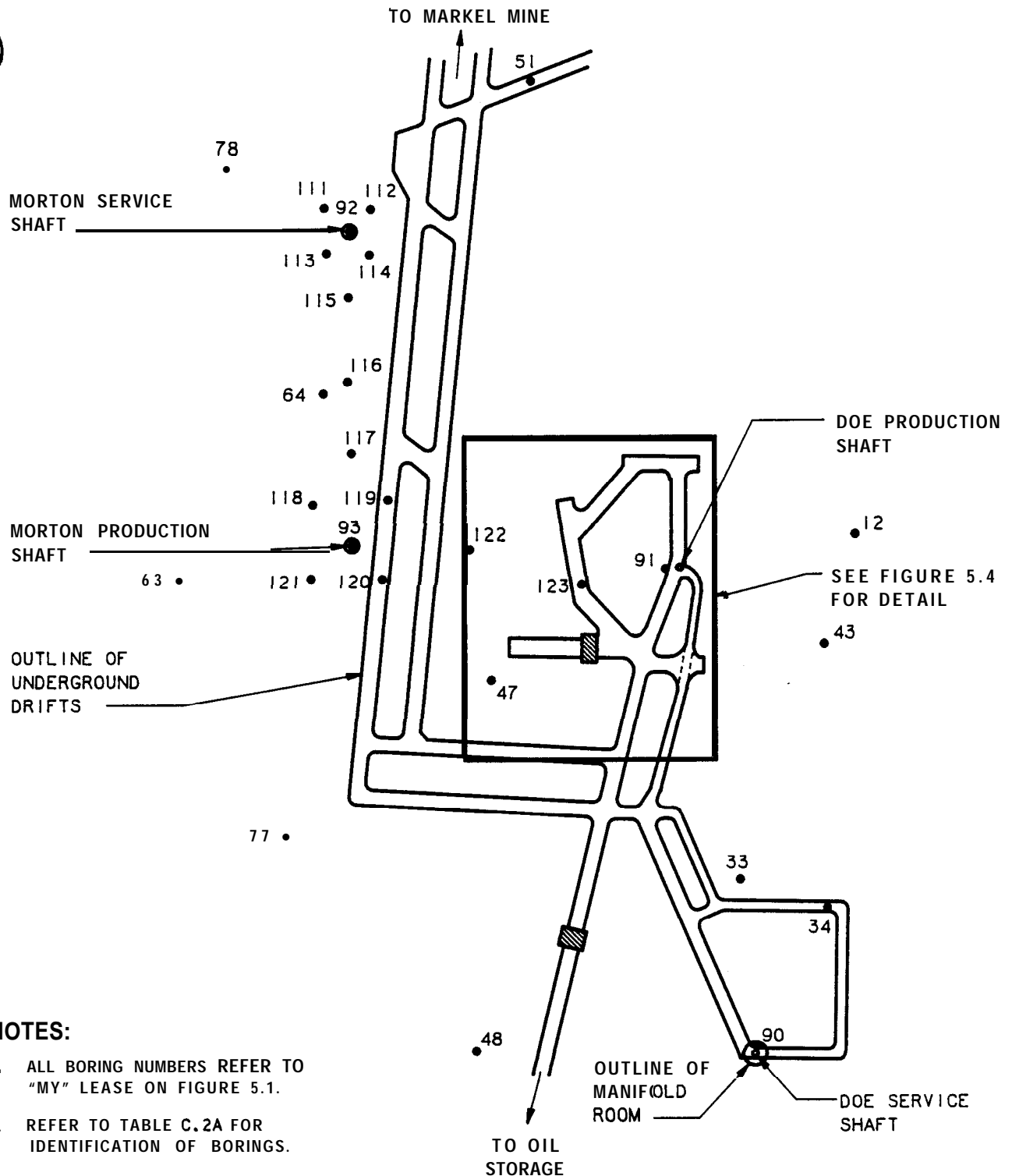
SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS
UPPER LEVEL

(Cont'd)

LONG-TERM TESTS WITH DIESEL FUEL

Site	Sample Number	Permeability (millidarcys)	Confining Pressure (psi)	Test Duration (hr)
B9-H1	20	6.5	200	Initial
		4.7	500	Initial
		2.3	500	10
		1.4	500	60
M4-H1	30	22.0	200	Initial
		15.0	500	Initial
		6.1	1,000	Initial
		1.8	1,000	10
		1.1	1,000	60





NOTES:

1. ALL BORING NUMBERS REFER TO "MY" LEASE ON FIGURE 5.1.
2. REFER TO TABLE C.2A FOR IDENTIFICATION OF BORINGS.

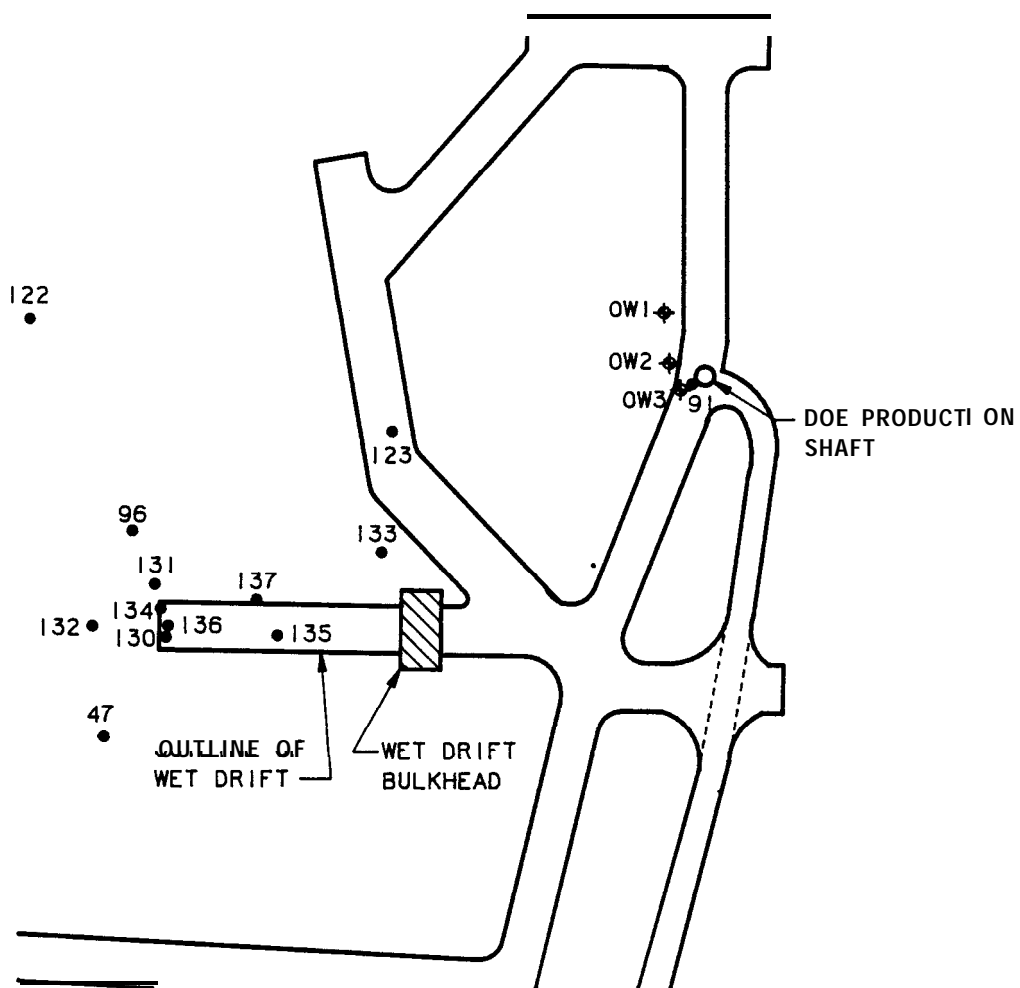
LEGEND:

78 BORING NUMBER AND
● LOCATION

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 250 500 FEET

ACRES	SANDIA NATIONAL LABORATORIES	
	WEEKS ISLAND SPR SITE	
DETAIL OF BORING LOCATIONS NEAR SHAFTS		
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN		FIGURE 5.3



NOTES:

1. ALL BORING NUMBERS REFER TO "MY" LEASE ON FIGURE 5.1.
2. REFER TO TABLE C.2A FOR IDENTIFICATION OF BORINGS.

LEGEND:

- 96 BORING NUMBER AND LOCATION
- OW1 ♦ OBSERVATION WELL NUMBER AND LOCATION

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 100 200 FEET



SANDIA NATIONAL LABORATORIES

WEEKS ISLAND SPR SITE

DETAIL OF BORING AND
OBSERVATION WELL LOCATIONS
NEAR WET DRIFT

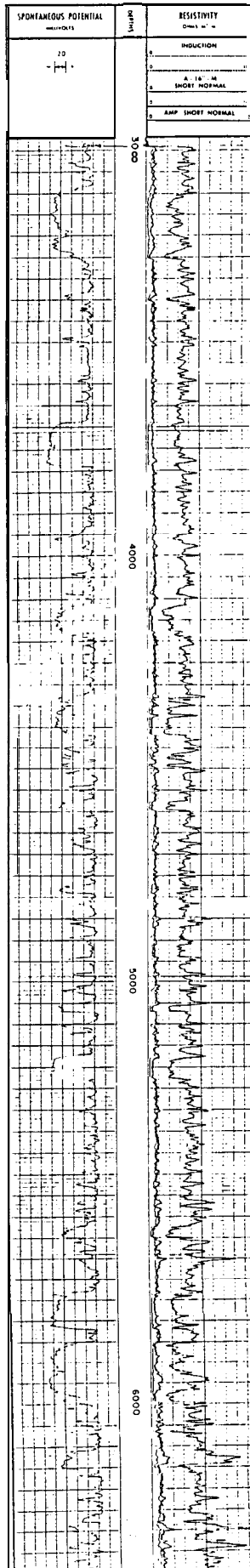
ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.4

MAY 1987

WELL: WG02

REFER TO FIGURE 5.1 FOR WELL LOCATION.
REFER TO TABLE 5.1 FOR IDENTIFICATION OF GEOLOGIC UNITS.



PLIOCENE

MIOCENE

TEXTULARIA

LAY
MARKER

SIGENERINA 2

TEXTULARIA W

SIGENERINA
HUMBLEI

CRISTELLARIA

TOP OF THE
MIOCENE



SANDIA NATIONAL LABORATORIES

WEEKS ISLAND SPR SITE

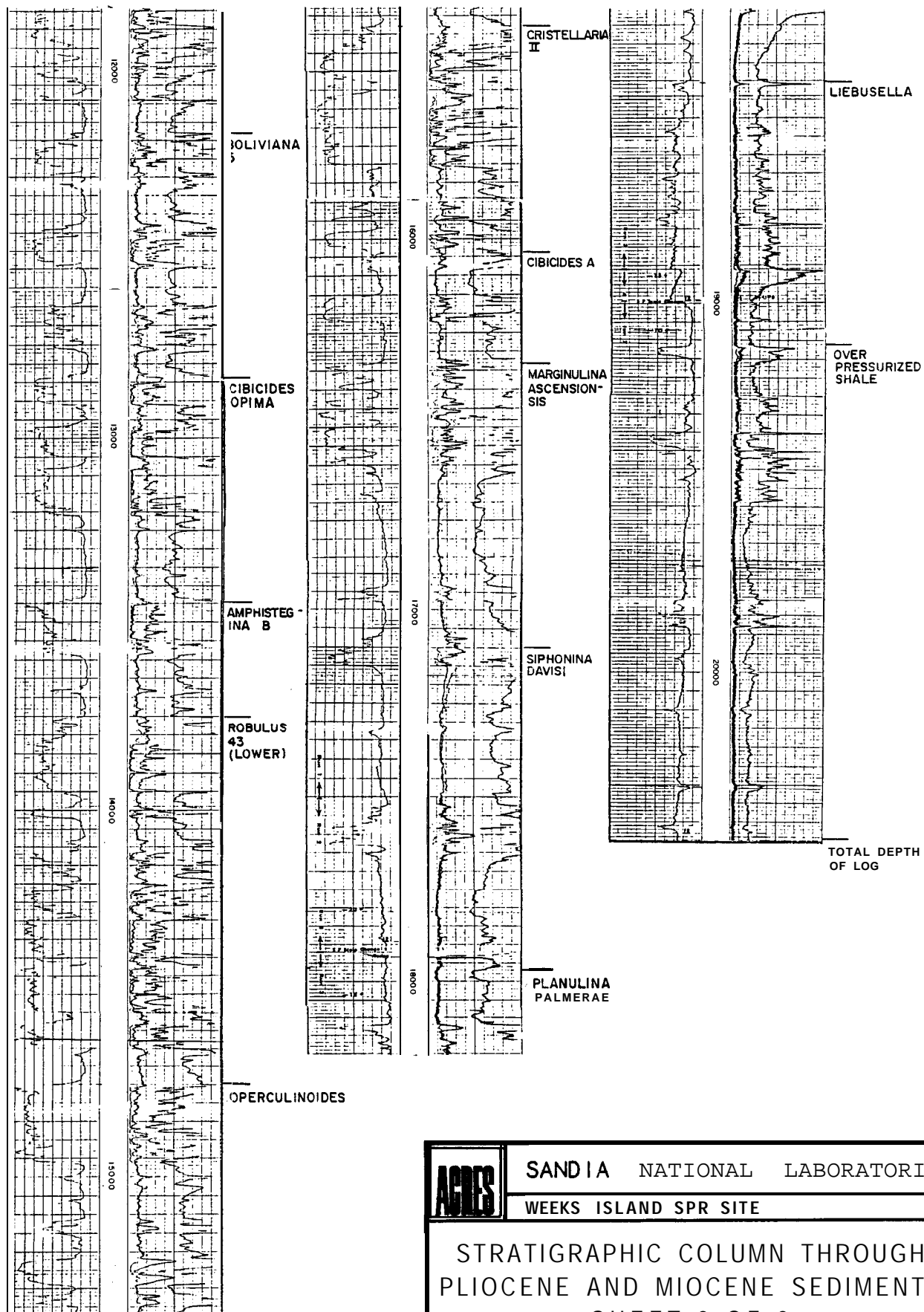
STRATIGRAPHIC COLUMN THROUGH PLIOCENE AND MIOCENE SEDIMENTS SHEET 1 OF 2

ACRES INTERNATIONAL CORPORATION

T. R. MAGORIAN

FIGURE 5.5

MAY 1987



ACRES

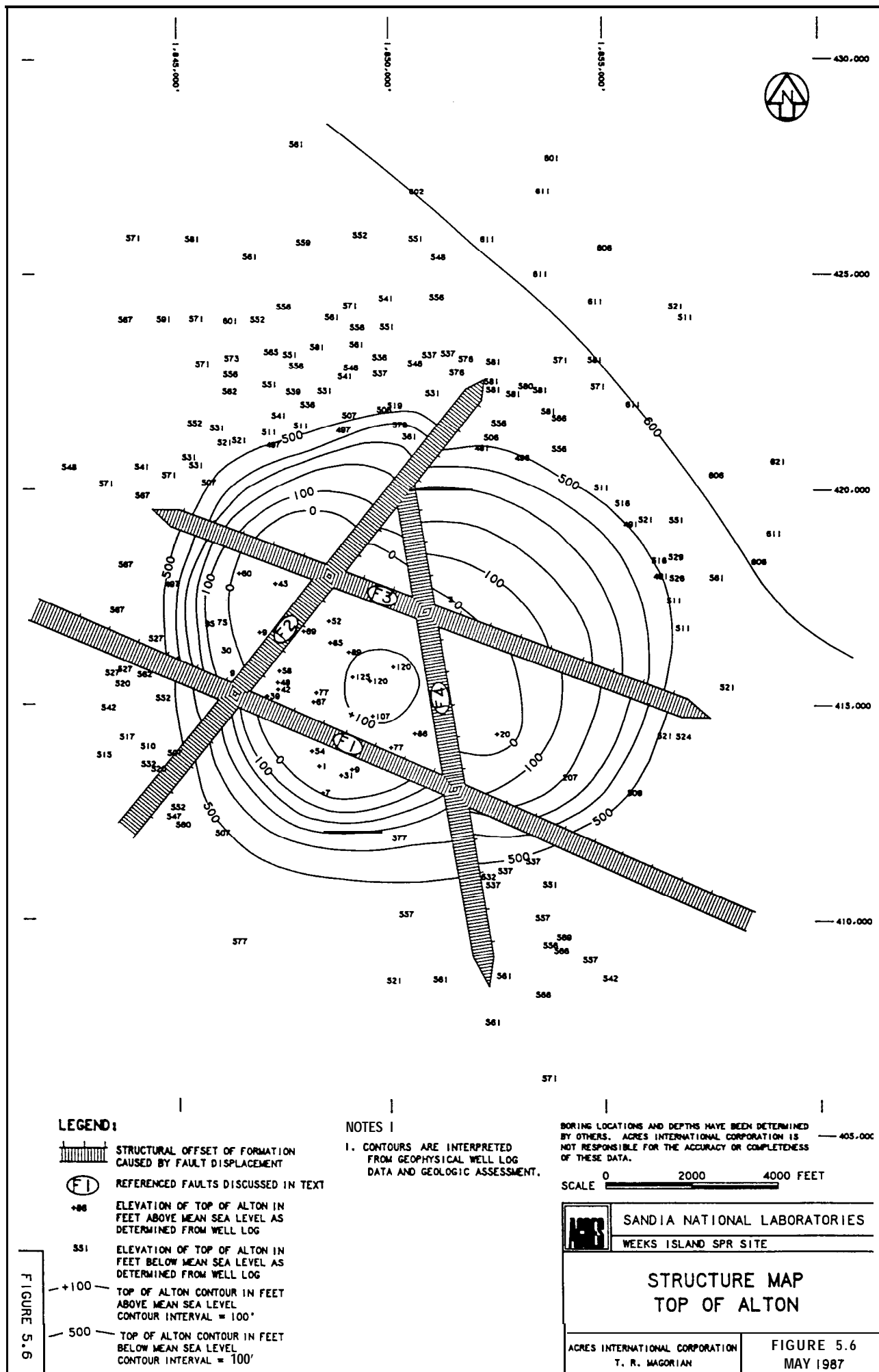
SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

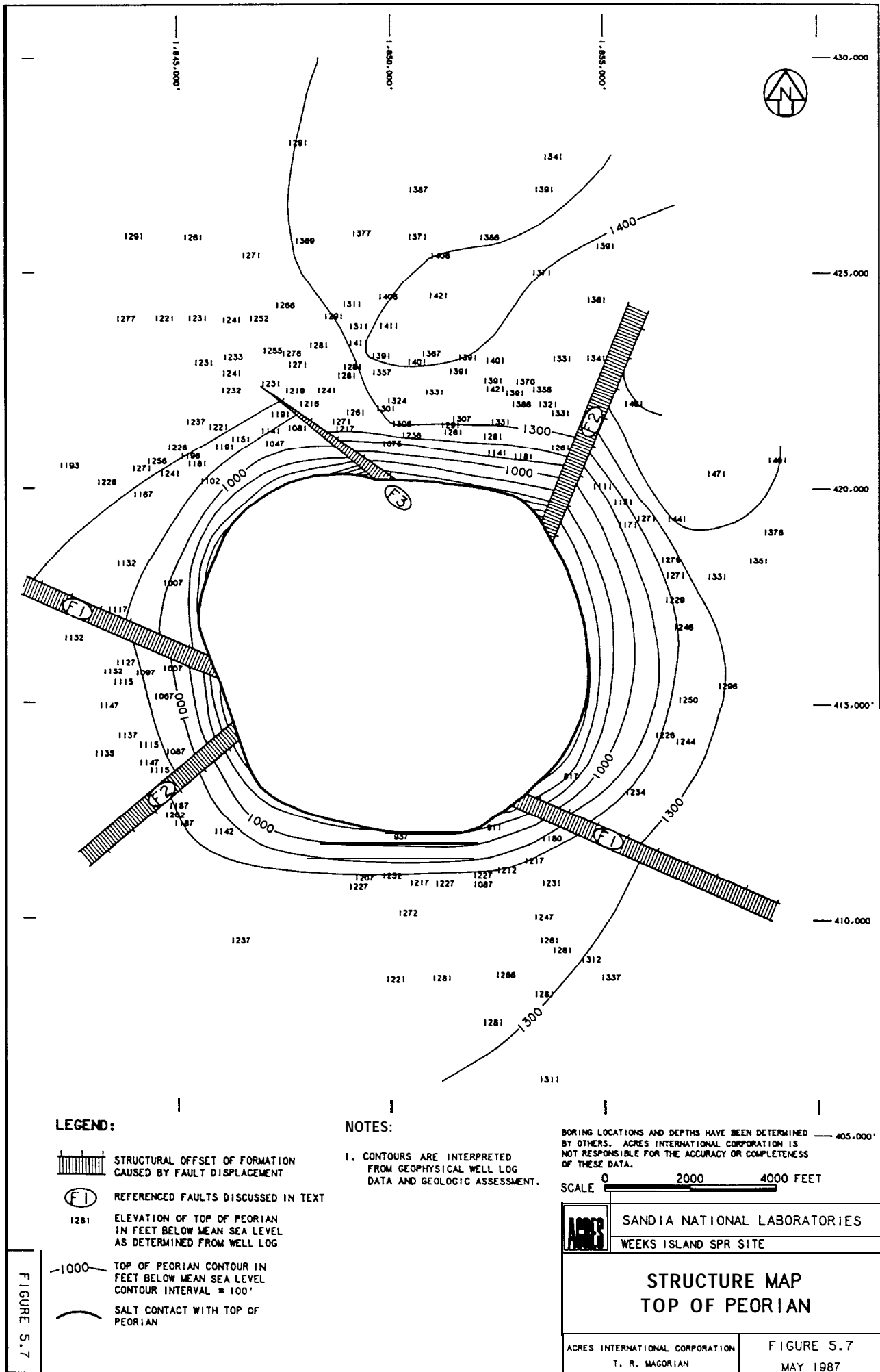
STRATIGRAPHIC COLUMN THROUGH PLIOCENE AND MIOCENE SEDIMENTS SHEET 2 OF 2

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.5

MAY 1987





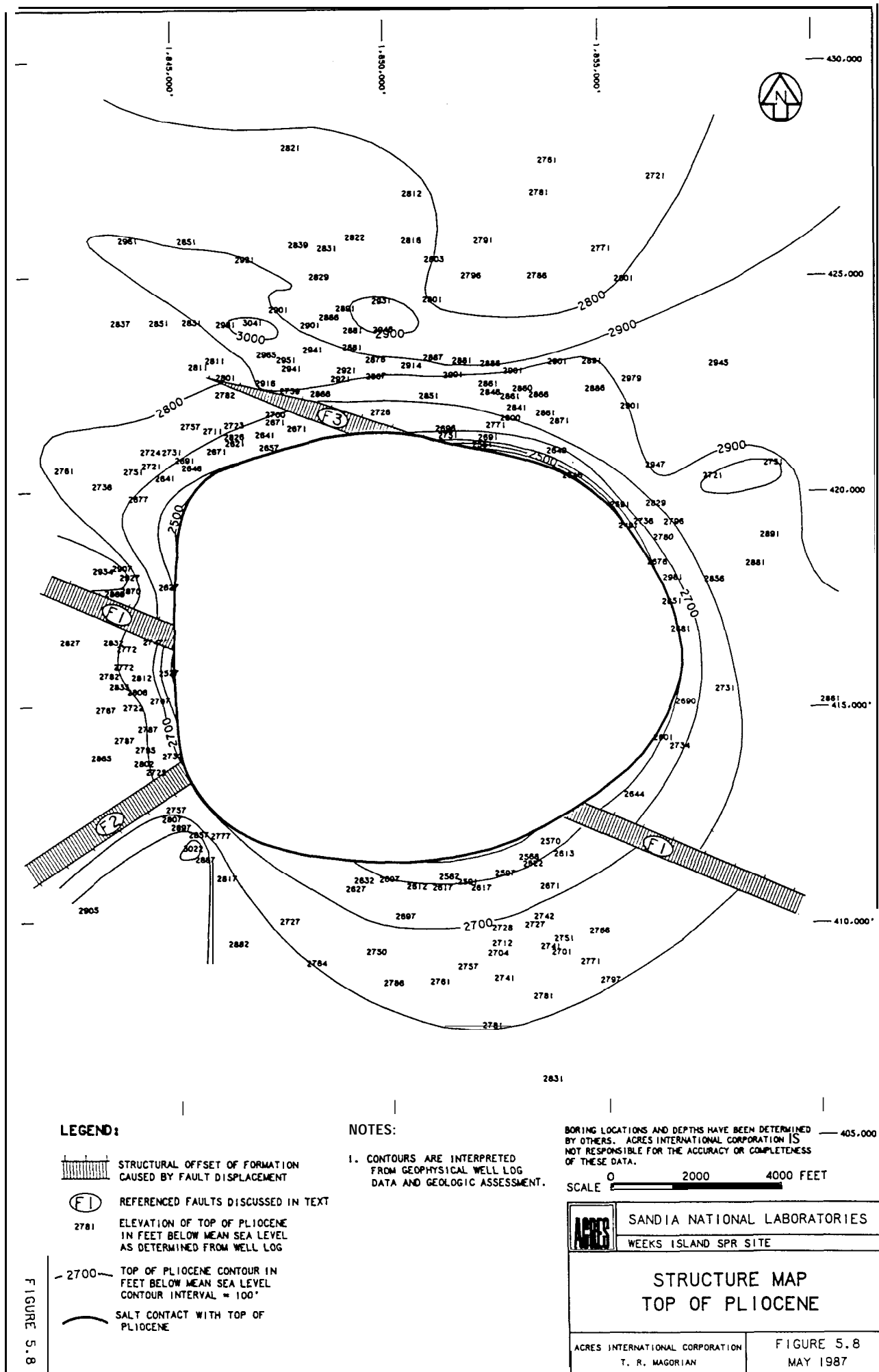
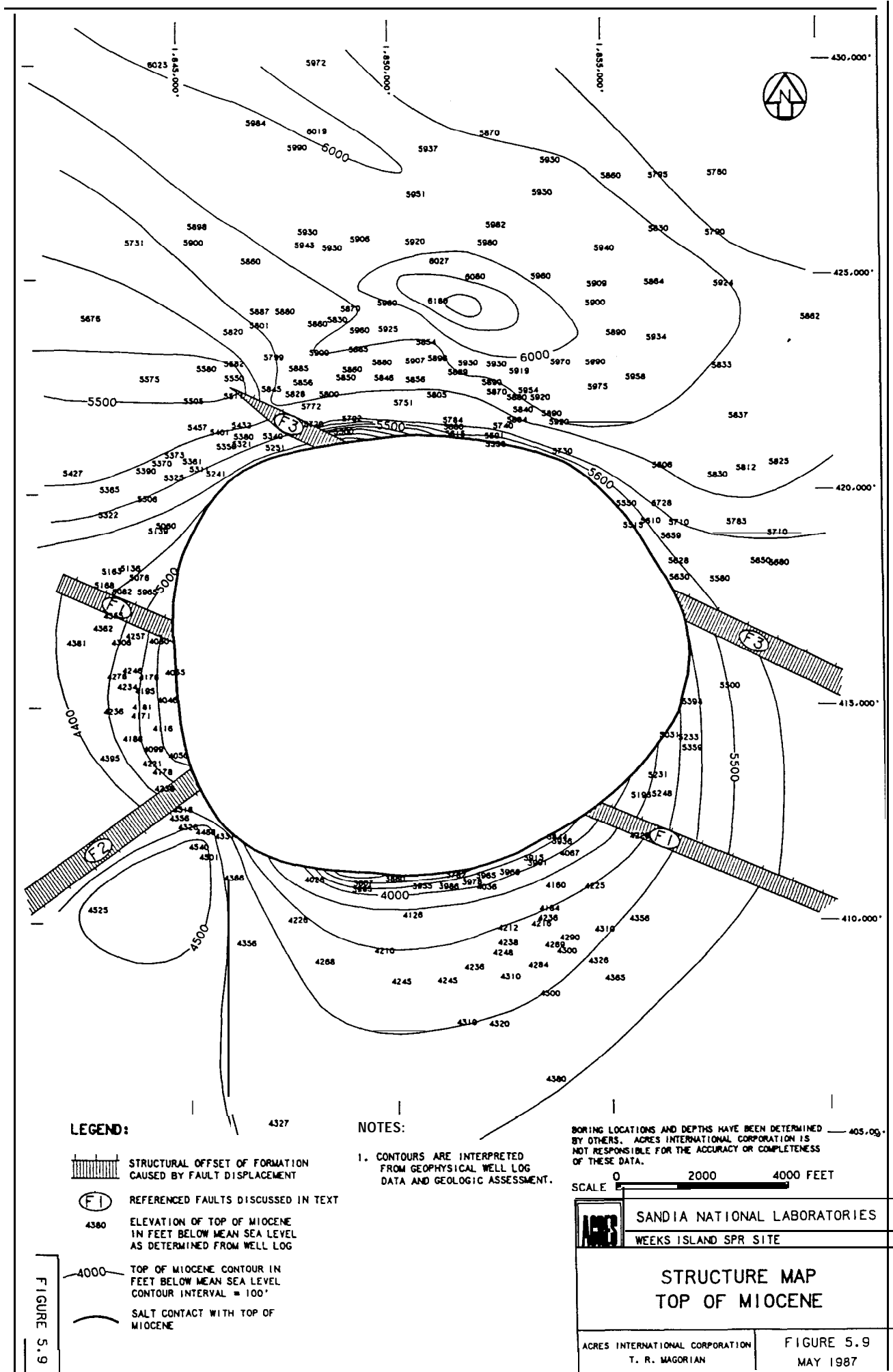
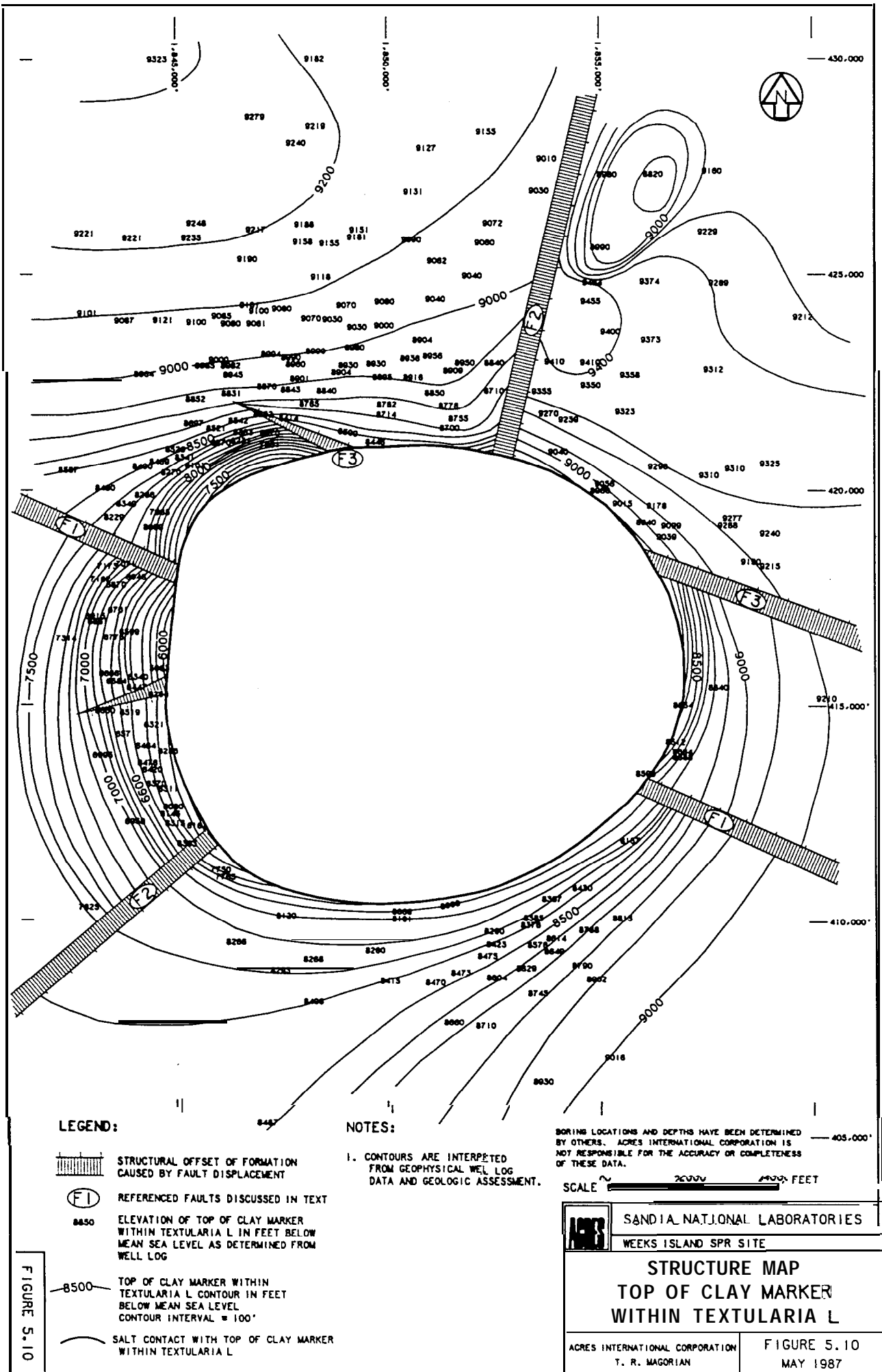


FIGURE 5.8





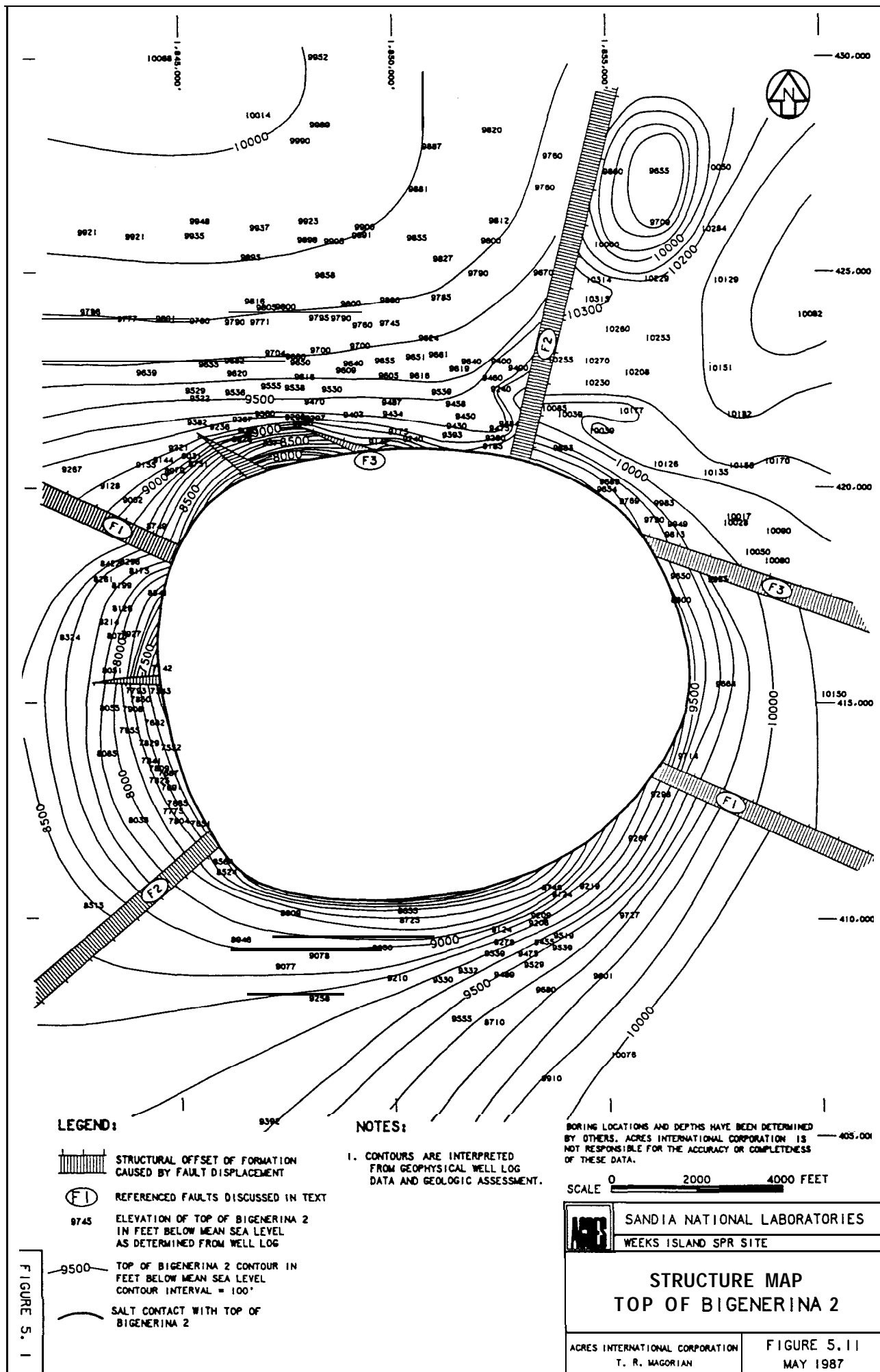
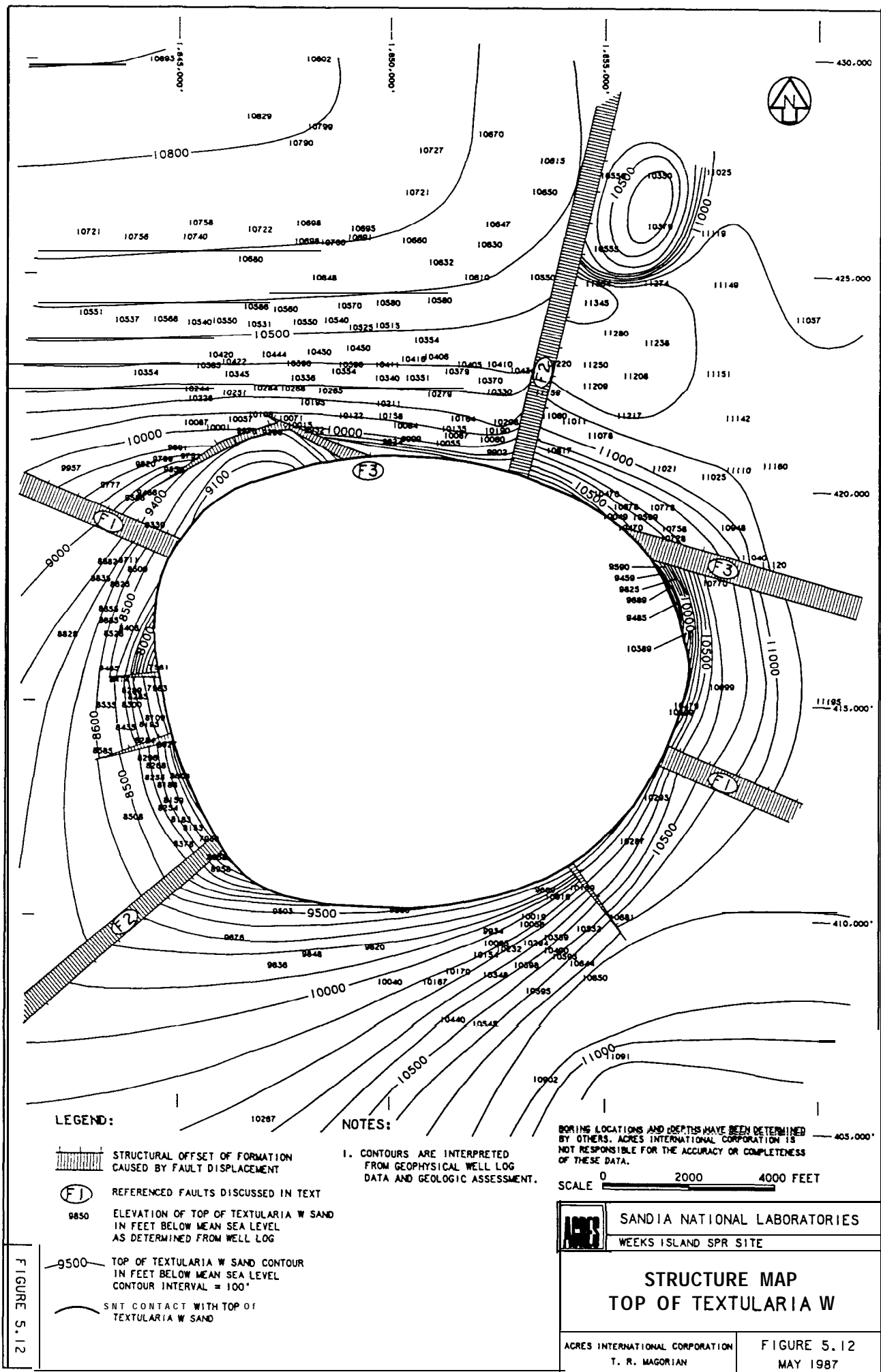
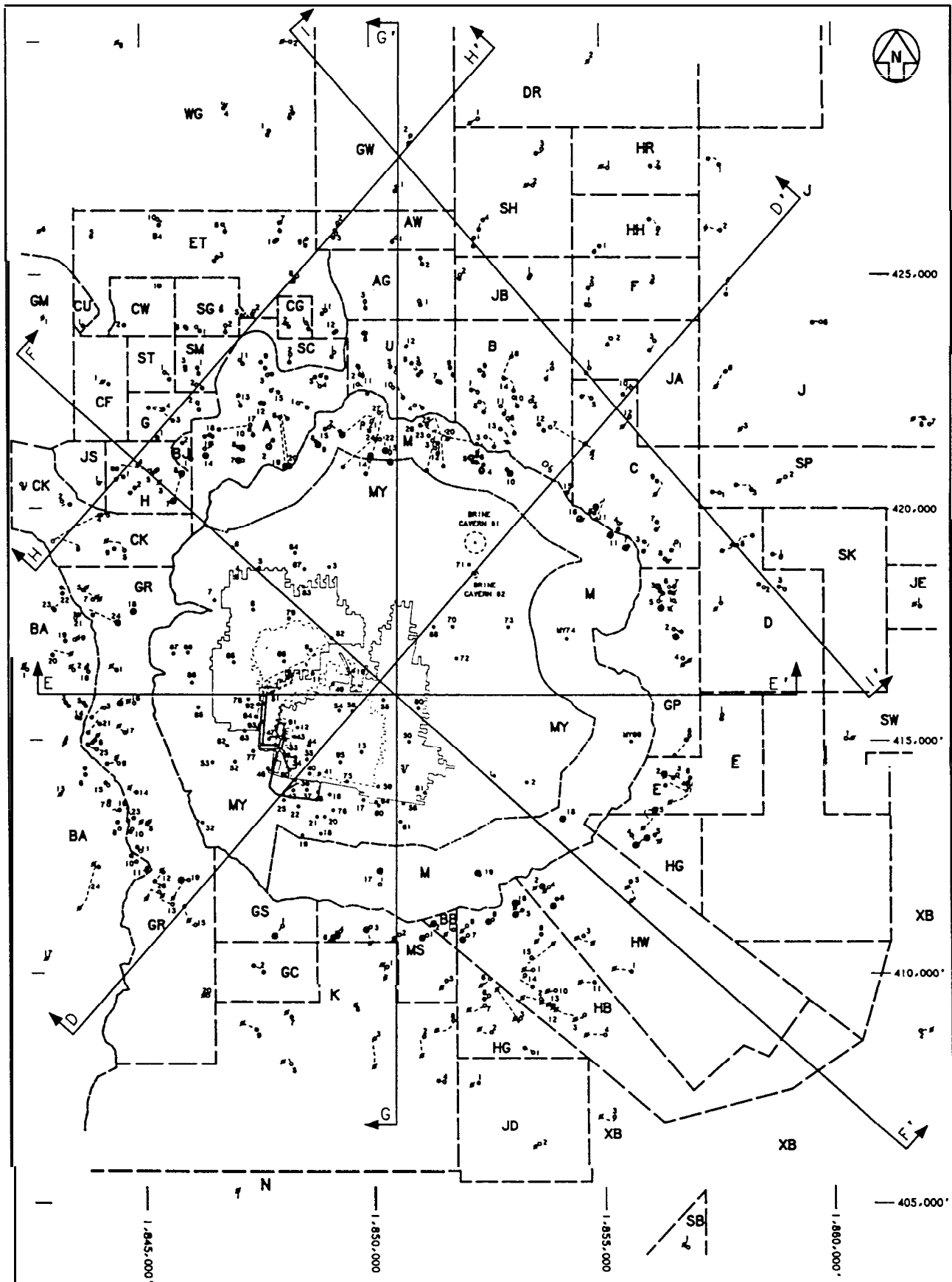


FIGURE 5.1






BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

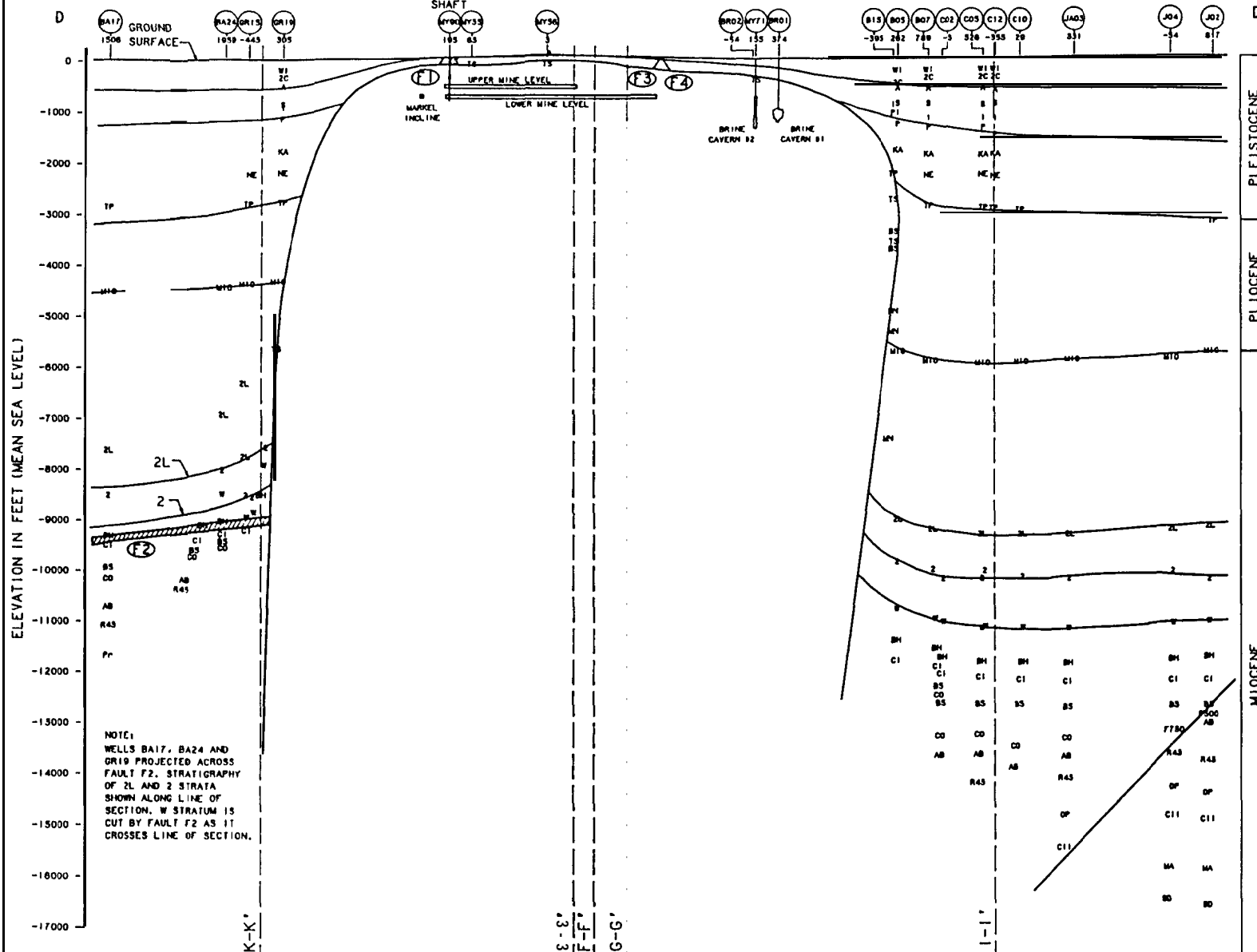
SCALE 0 2000 4000 FEET

FIGURE 5.13

 SANDIA NATIONAL LABORATORIES WEEKS ISLAND SPR SITE	
SECTION LOCATION MAP	
ACRES INTERNATIONAL CORPORATION T. R. MAGORIAN	FIGURE 5.13 MAY 1987

SOUTHWEST

NORTHEAST



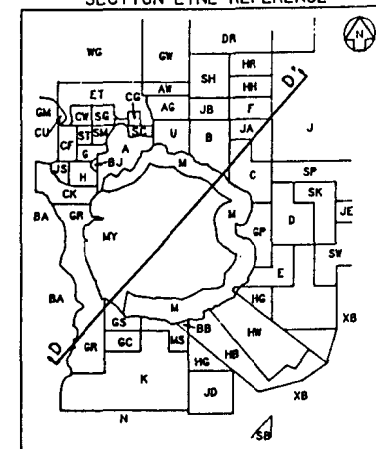
NOTES:

1. REFER TO FIGURE 5.13 FOR WELL LOCATIONS RELATIVE TO SECTION LINE.
2. REFER TO TABLE 5.1 FOR DEFINITION OF GEOLOGIC SYMBOLS.

LEGEND:

- (J02)
B17
- WELL NAME AND PERPENDICULAR DISTANCE (FT.) PROJECTED TO SECTION LINE. NEGATIVE DISTANCE PROJECTED FROM BEHIND VIEWING PERSPECTIVE
- (F1)
- FAULTS DISCUSSED IN SECTION 5
- F750
- IDENTIFIED FAULT AND COMPUTED OFFSET

SECTION LINE REFERENCE



BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

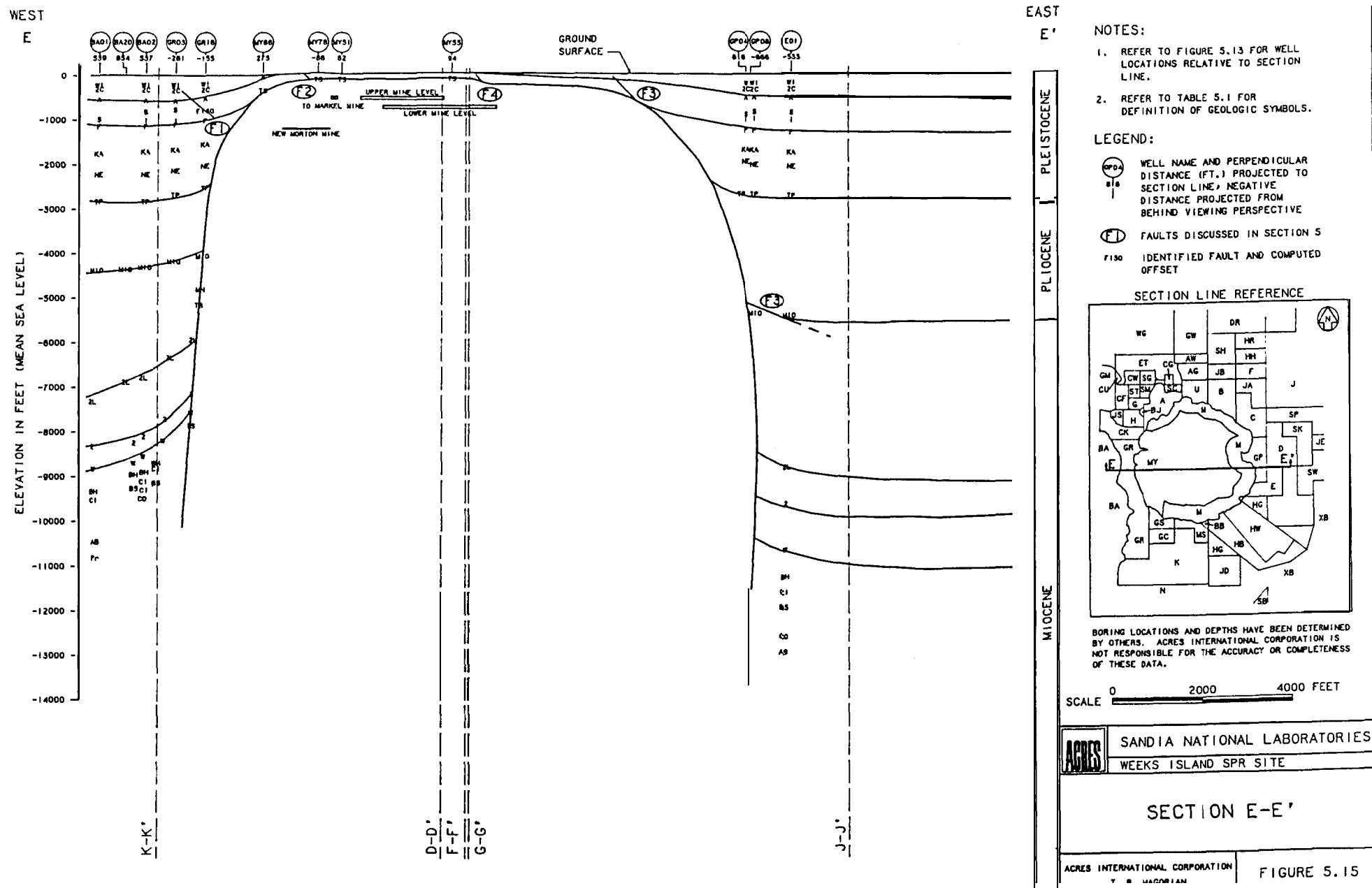
SCALE 0 2000 4000 FEET

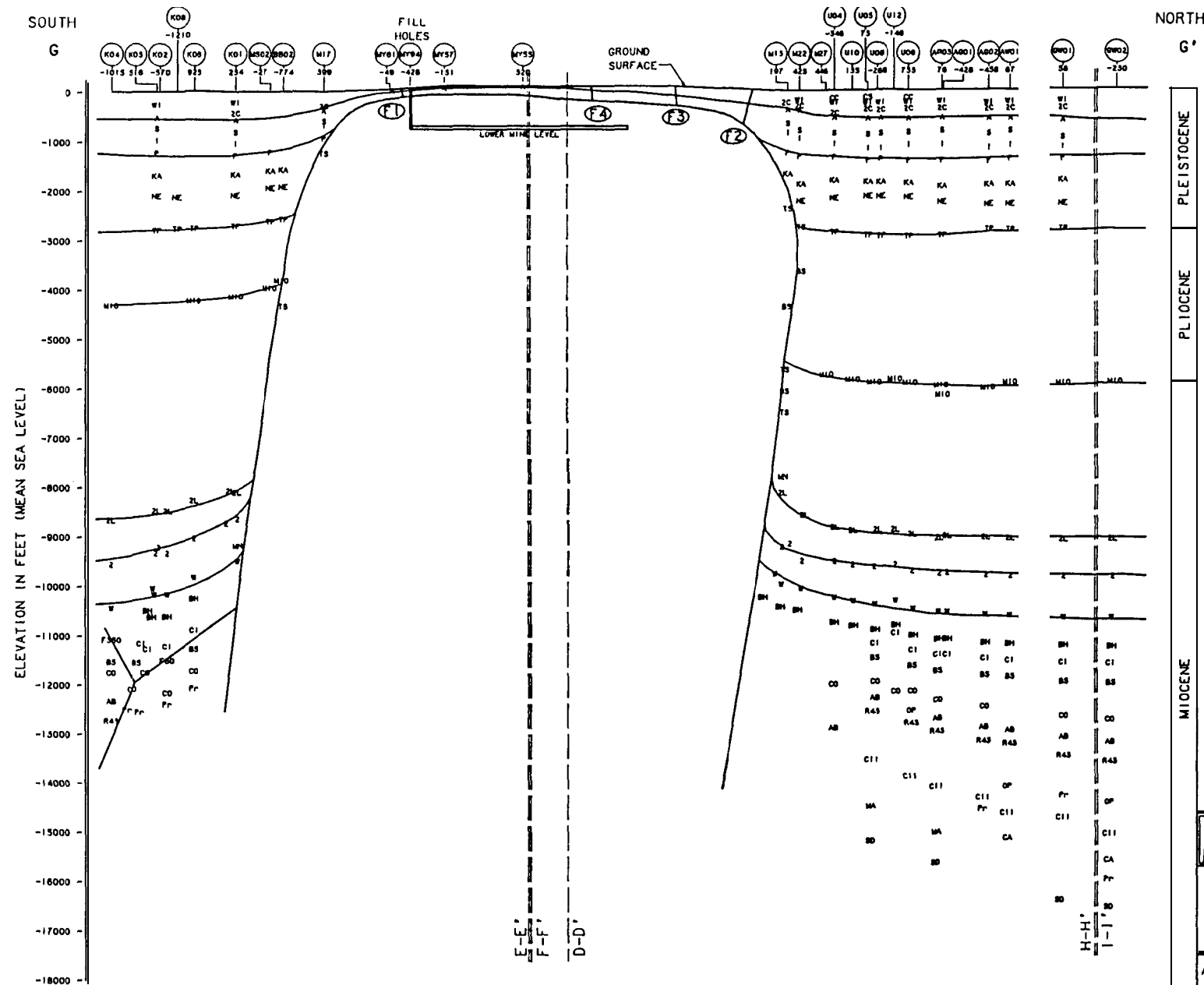
ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

SECTION D-D'

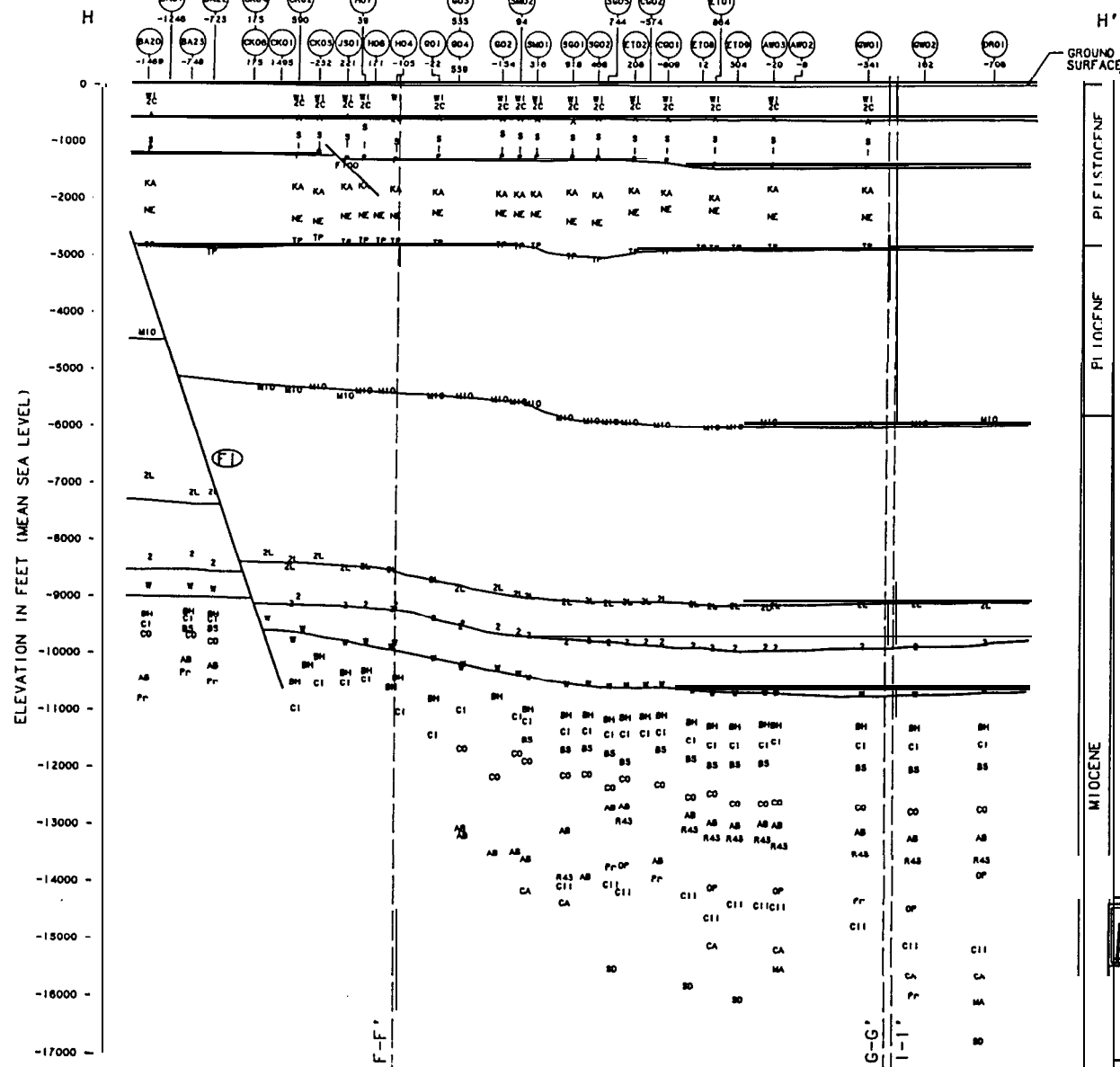
FIGURE 5.14





SOUTHWEST

NORTHEAST



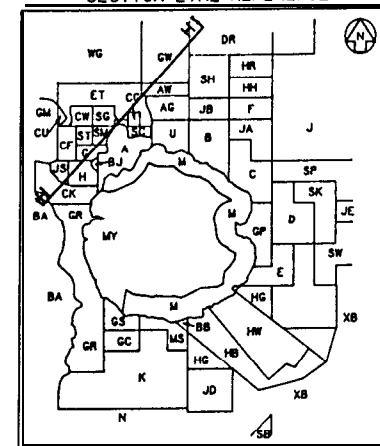
NOTES:

1. REFER TO FIGURE 5.13 FOR WELL LOCATIONS RELATIVE TO SECTION LINE.
2. REFER TO TABLE 5.1 FOR DEFINITION OF GEOLOGIC SYMBOLS.

LEGEND:

- WELL NAME AND PERPENDICULAR DISTANCE (FT.) PROJECTED TO SECTION LINE; NEGATIVE DISTANCE PROJECTED FROM BEHIND VIEWING PERSPECTIVE
- FAULTS DISCUSSED IN SECTION 5
- IDENTIFIED FAULT AND COMPUTED OFFSET

SECTION LINE REFERENCE



BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 2000 4000 FEET



SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

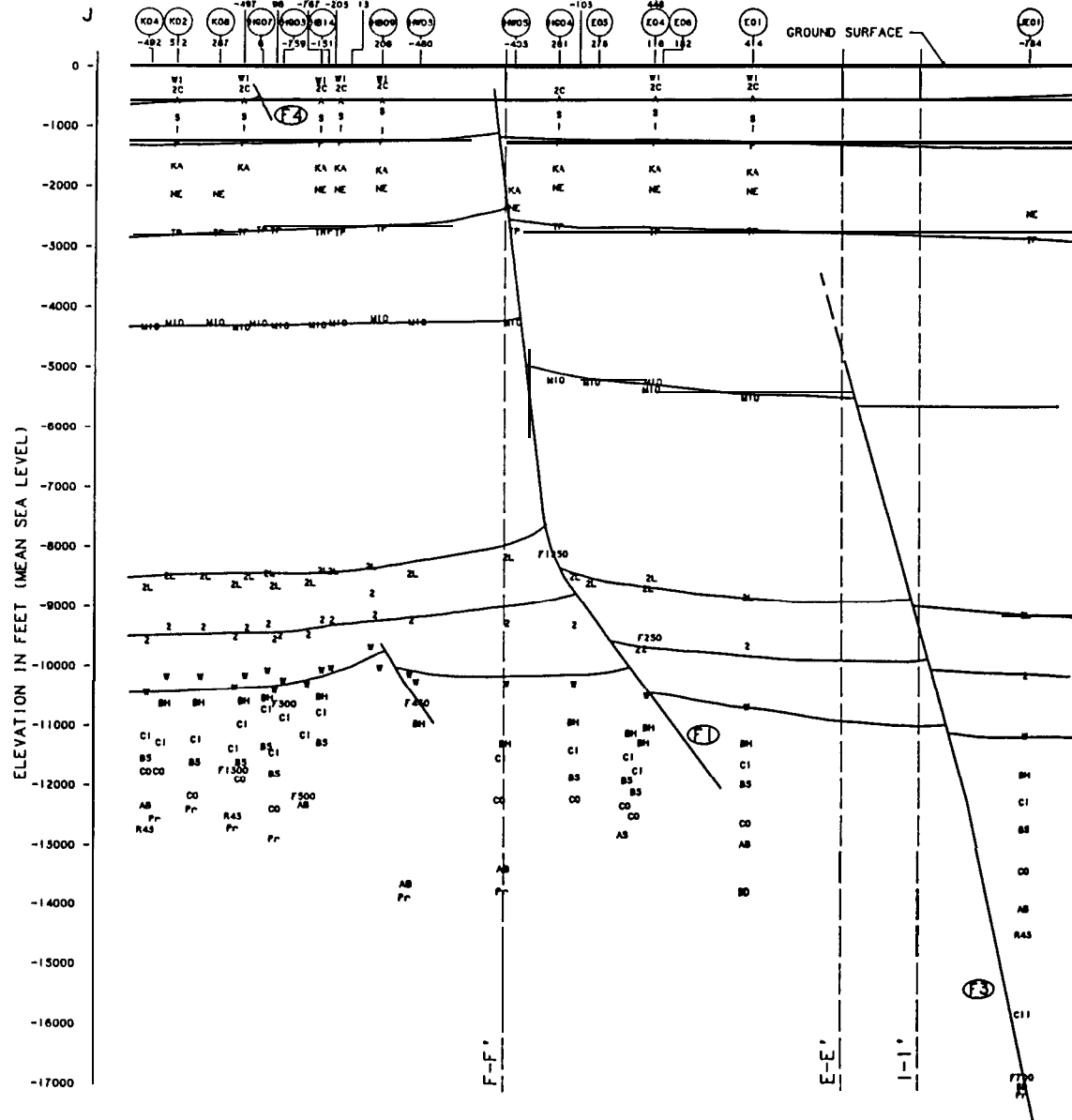
SECTION H-H'

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.18

SOUTHWEST

NORTHEAST



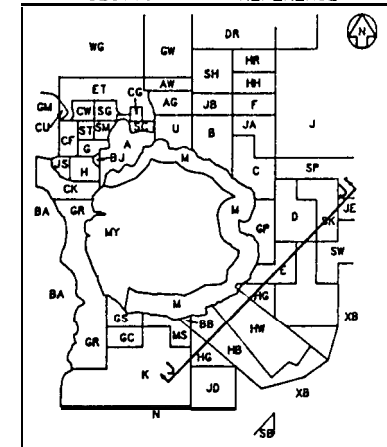
NOTES:

1. REFER TO FIGURE 5.13 FOR WELL LOCATIONS RELATIVE TO SECTION LINE.
2. REFER TO TABLE 5.1 FOR DEFINITION OF GEOLOGIC SYMBOLS.

LEGEND:

- WELL NAME AND PERPENDICULAR DISTANCE (FT.) PROJECTED TO SECTION LINE; NEGATIVE DISTANCE PROJECTED FROM BEHIND VIEWING PERSPECTIVE
- FAULTS DISCUSSED IN SECTION 5
- IDENTIFIED FAULT AND COMPUTED OFFSET

SECTION LINE REFERENCE



BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 2000 4000 FEET



SANDIA NATIONAL LABORATORIES

WEEKS ISLAND S.P.R. SITE

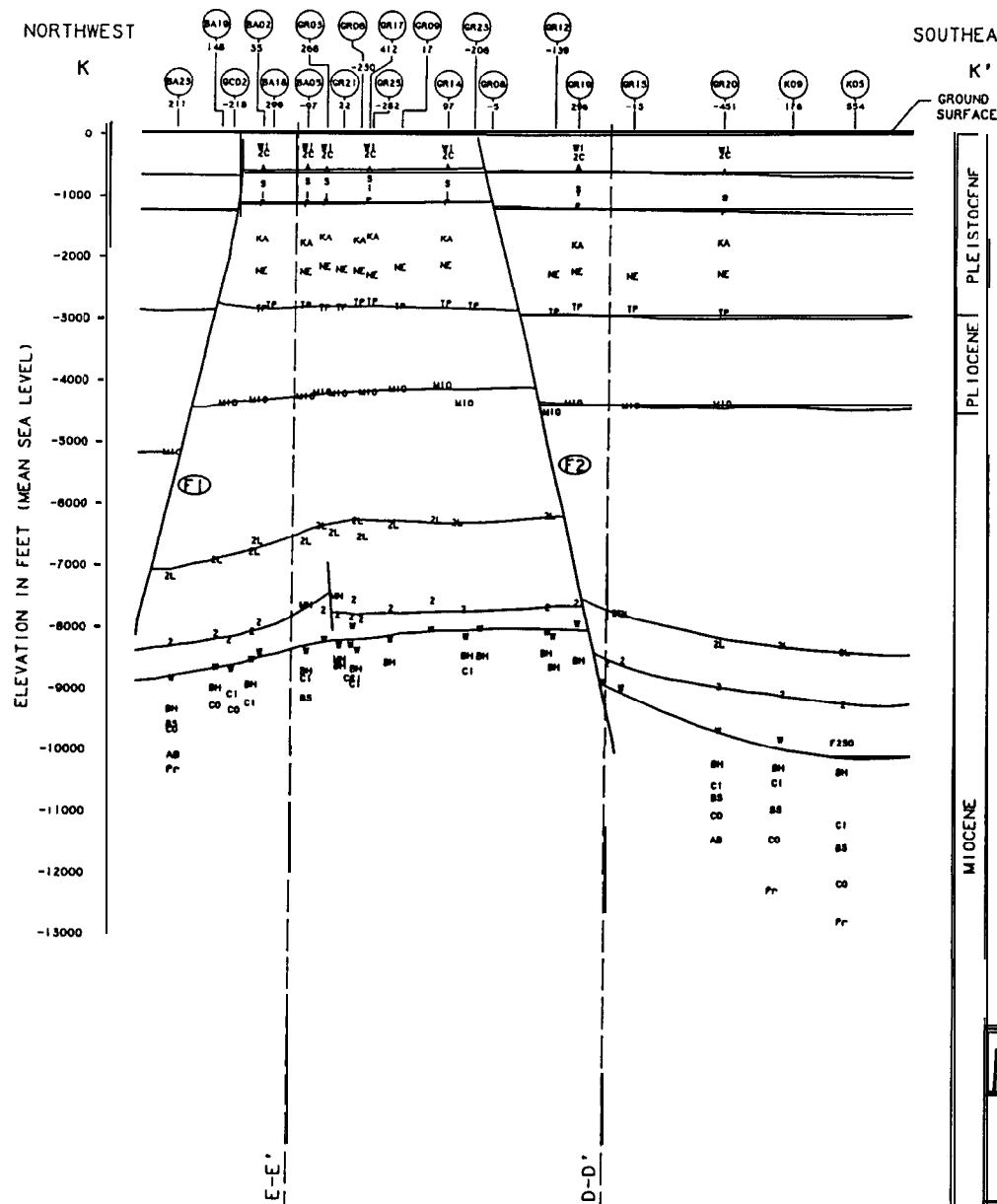
SECTION J-J'

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.20

NORTHWEST

SOUTHEAST



NOTES:

1. REFER TO FIGURE 5.13 FOR WELL LOCATIONS RELATIVE TO SECTION LINE.
2. REFER TO TABLE 5.1 FOR DEFINITION OF GEOLOGIC SYMBOLS.

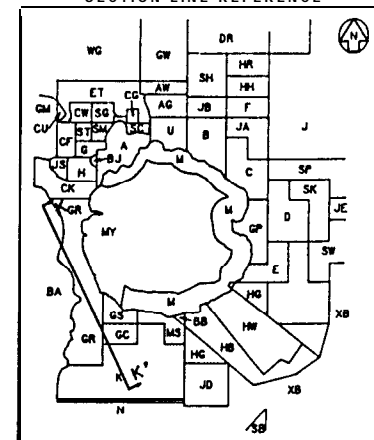
LEGEND:

(K03) WELL NAME AND PERPENDICULAR DISTANCE (FT.) PROJECTED TO SECTION LINE; NEGATIVE DISTANCE PROJECTED FROM BEHIND VIEWING PERSPECTIVE

(F1) FAULTS DISCUSSED IN SECTION 5

F250 IDENTIFIED FAULT AND COMPUTED OFFSET

SECTION LINE REFERENCE



BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

0 2000 4000 FEET
S C A



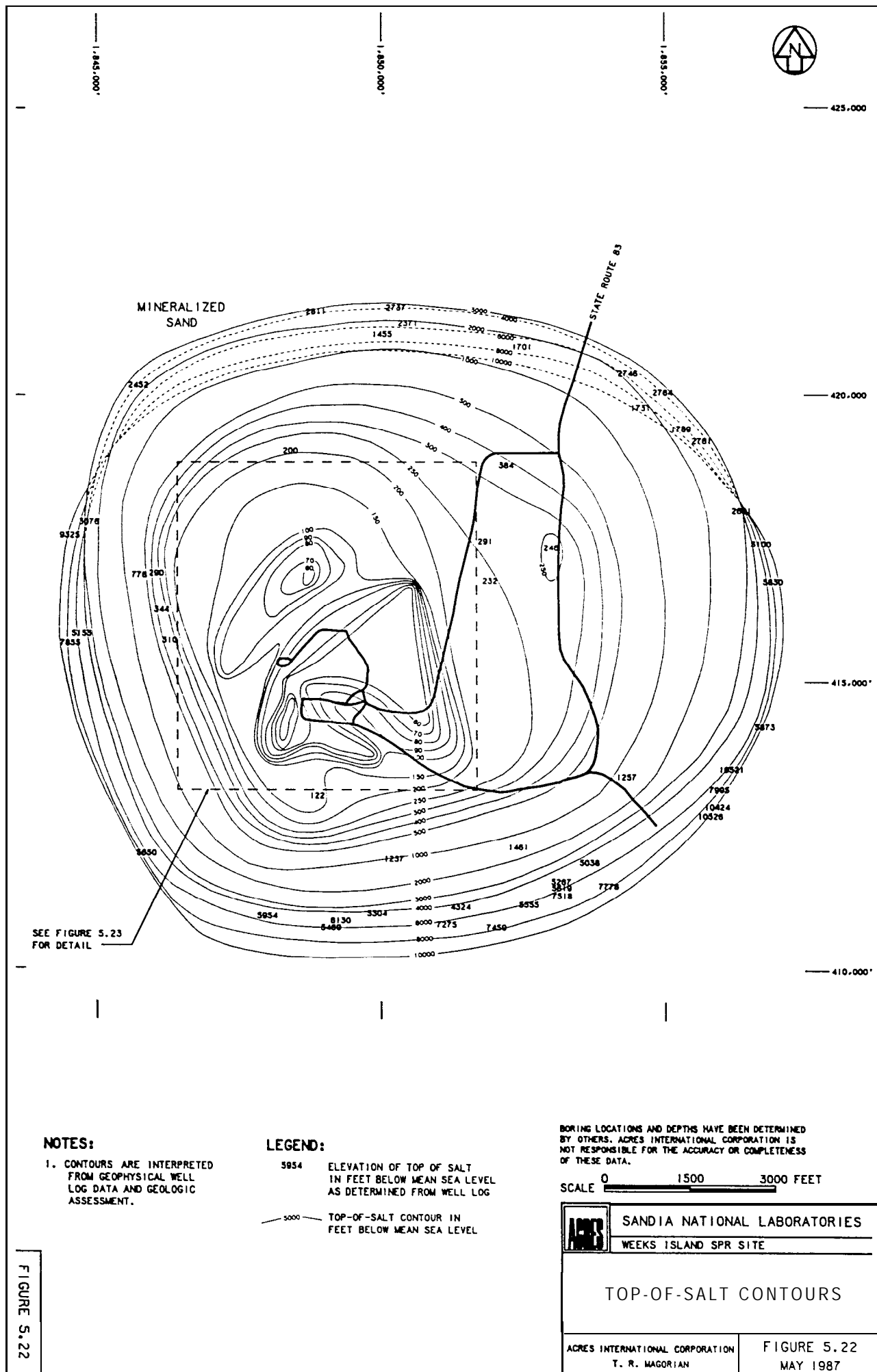
SANDIA NATIONAL LABORATORIES

WEEKS ISLAND SPR SITE

SECTION K-K'

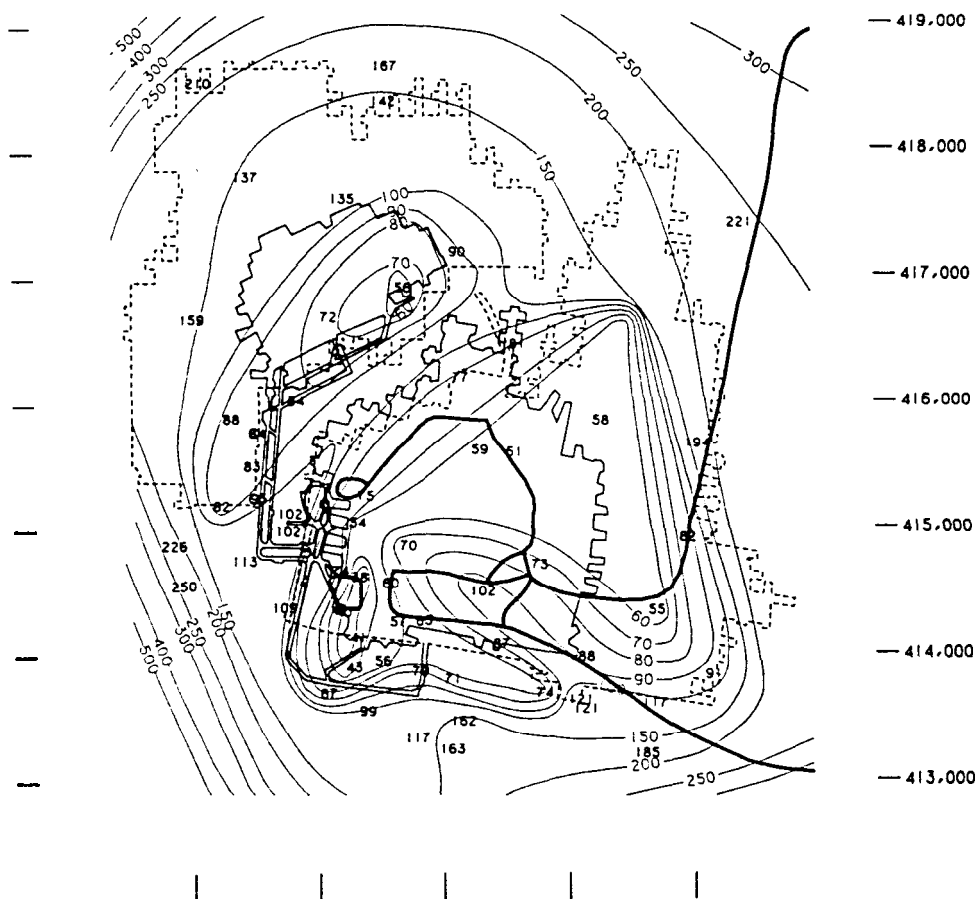
AC: S INTERNATIONAL CORPORAT ON
T. R. MAGORIAN

FIGURE 5.21





1,847,000
1,848,000
1,849,000
1,850,000



LEGEND:

226 ELEVATION OF TOP OF SALT IN FEET BELOW MEAN SEA LEVEL AS DETERMINED FROM WELL LOG

200 TOP OF SALT CONTOUR IN FEET BELOW MEAN SEA LEVEL

LIMITS OF MINE WORKINGS

NOTES:

1. CONTOURS ARE INTERPRETED FROM GEOPHYSICAL WELL LOG DATA AND GEOLOGIC ASSESSMENT.

2. REFER TO FIGURE 5.2 FOR WELL NUMBERS.

BORING LOCATIONS AND DEPTHS HAVE BEEN DETERMINED BY OTHERS. ACRES INTERNATIONAL CORPORATION IS NOT RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THESE DATA.

SCALE 0 1000 2000 FEET

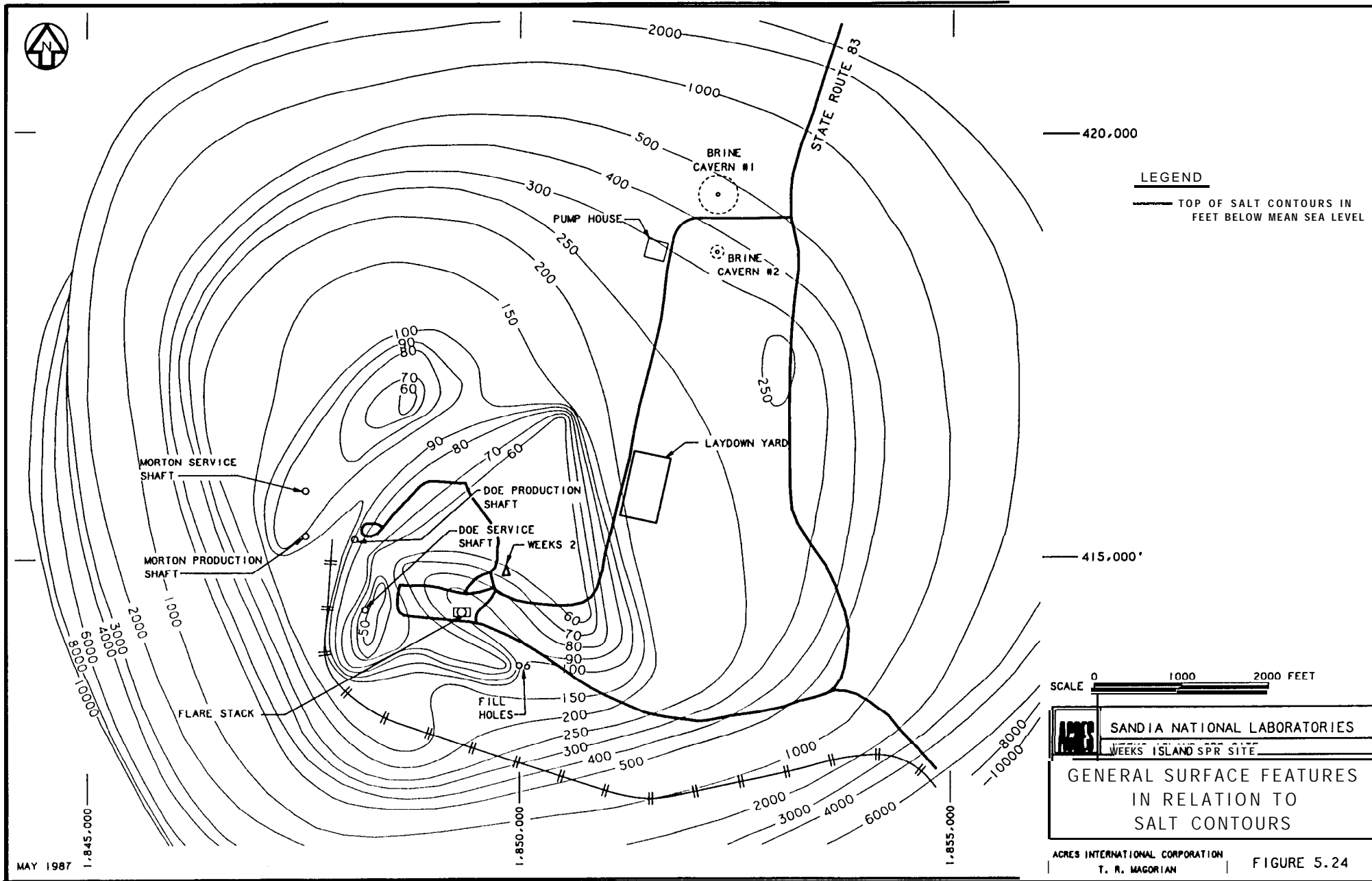
SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

DETAIL OF SALT CONTOURS
OVER MINES

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.23
MAY 1987

FIGURE 5.23



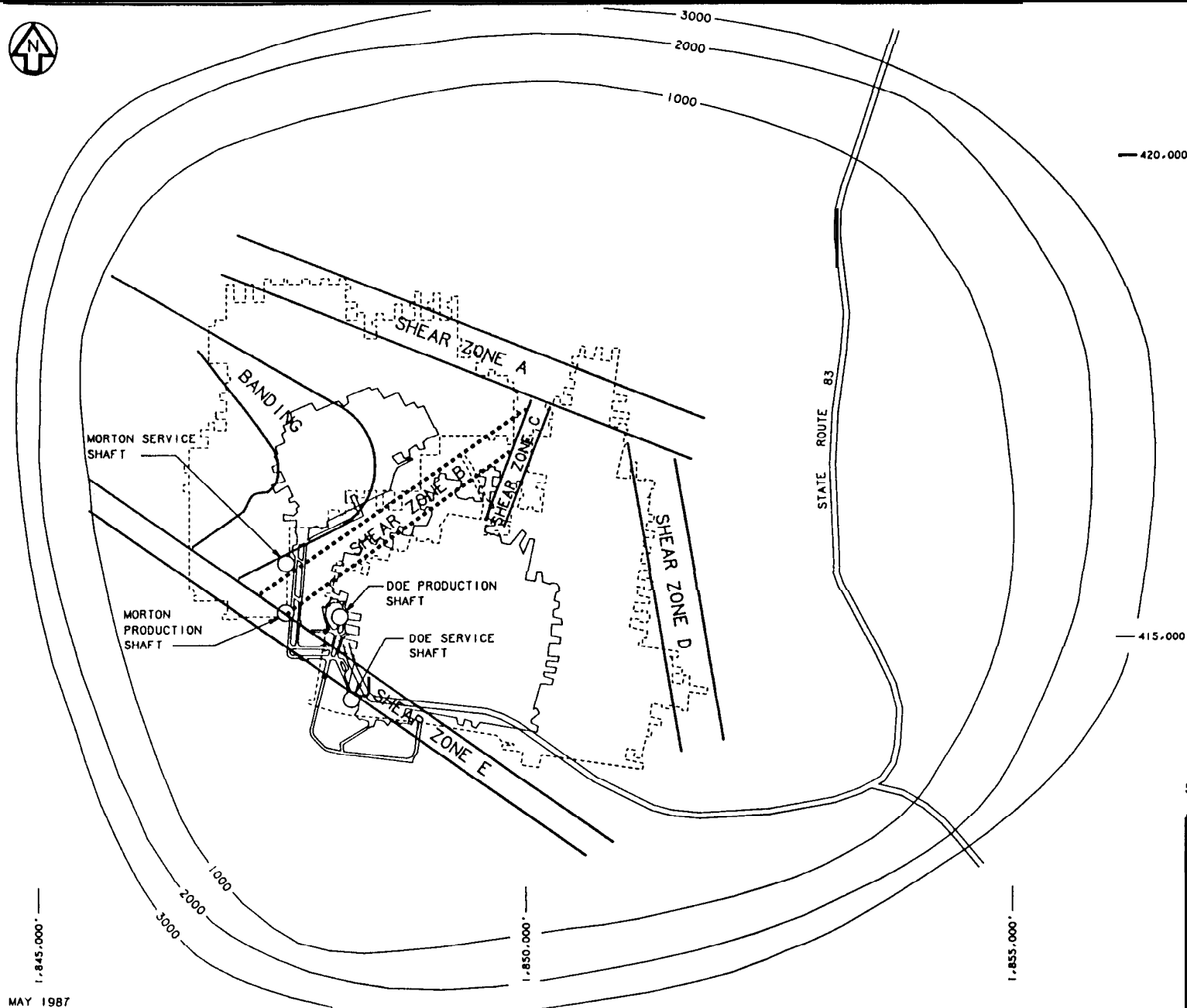


NOTES:

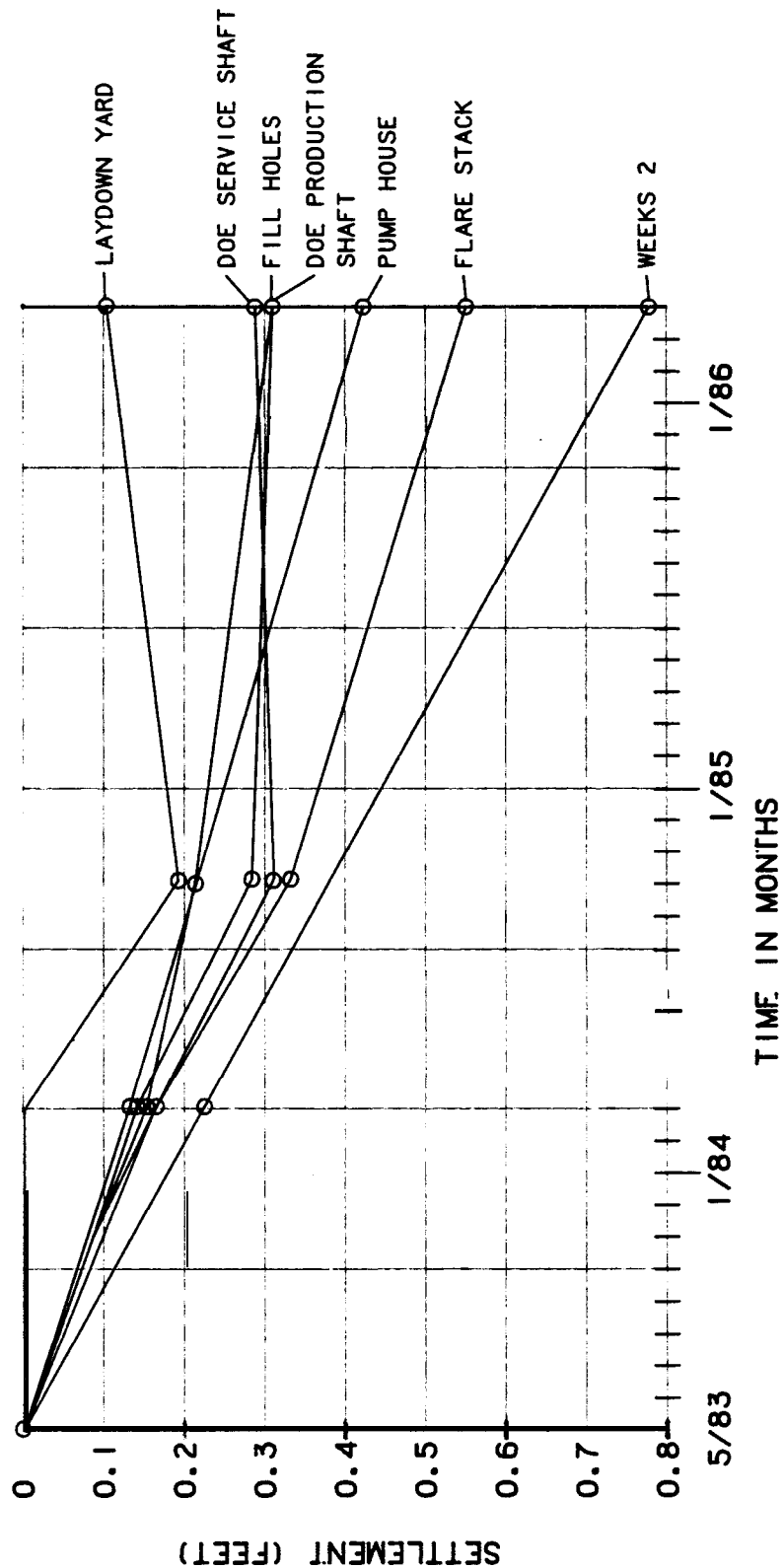
1. CONTOURS ARE INTERPRETED FROM BORING DATA, SURFACE TOPOGRAPHY, OIL WELL DATA, AND GEOLOGIC ASSESSMENT.
2. REFER TO FIGURE 5.26 FOR TOP OF SALT CONTOURS.

LEGEND:

- 1000 — TOP OF SALT CONTOUR IN FEET BELOW MEAN SEA LEVEL
- — — — — ESTIMATED LIMIT OF SHEAR ZONE IDENTIFIED BY DR. DONALD KUPFER
- • • • • ESTIMATED LIMIT OF SHEAR ZONE PROJECTED BY DR. T.R. MAGORIAN AND ACRES INTERNATIONAL CORP.
- — — — — LIMITS OF MINE WORKINGS



MAY 1987



NOTES

- THE INFORMATION ON THIS FIGURE WAS PROVIDED BY PB-KBB.
- 2. REFER TO FIGURE 2.3 FOR LOCATIONS OF MONITORING POINTS.



SANDIA NATIONAL LABORATORIES
WEEKS ISLAND SPR SITE

SETTLEMENT OVER OIL STORAGE AREA

ACRES INTERNATIONAL CORPORATION
T. R. MAGORIAN

FIGURE 5.26

MAY 1987

6 - STABILITY OF MINES AT WEEKS ISLAND

6.1 - Introduction

Considerable efforts have been undertaken in previous studies to determine the stability of mines within the Weeks Island salt stock. These efforts have focused on two areas of concern: (1) the ability to safely mine and extract salt and, (2) the containment potential and security of the SPR. The 1977 and 1979 (Acres) studies described previously, focused their attention on the stability of the underground openings and shafts. The SNL (1985) report included an evaluation of mine and shaft stability with respect to a risk assessment for the DOE SPR. The 1986 (Acres) studies concentrated on the stability and potential failure scenarios of the shafts.

Presented in this section is a summary of the previous findings as they apply to the stability of the mine roofs, pillars and shafts, together with the geologic hazards to the SPR facility. More details and analysis of the specific issues may be found in the referenced reports.

6.2 - Pillar Stability

A number of factors affect the degree of stability of pillars in mines at Weeks Island. Stability of pillars in the salt is a function of the size and shape of the pillar, room height, room span, depth of the mine, time frame under consideration, strength of the salt, and mining techniques. The primary methods through which pillars decay is through slabbing and exfoliation. In a study done by Dr. Donald Kupfer for Gulf

Interstate Engineering Company in 1977 and included as an Appendix to the Acres 1977 report on the upper and lower SPR mines, the mechanisms of mine decay were reviewed and their effects on pillars assessed. Joints in the walls (pillars) of rooms were mapped to determine if any pattern existed to their orientation. It was found that the joints in the walls are sub-parallel to the walls and are oriented with respect to the direction of mining. Since the salt is naturally rheologic and contains no natural jointing, it can be assumed these developed during or shortly after mining of the rooms. These joints become planes of weakness along which slabbing and exfoliation may occur. Depending on the direction of mining undertaken when a pillar is formed, a pillar corner can be formed by either convergent, divergent, or continuous excavation. The size of the block formed at the corner of the pillar by the intersecting joints is then dependent on the direction of mining undertaken to form the pillar corner.

Also in 1977, a mine stability study was undertaken by Acres (1977) for the SPR facility. The study involved:

- Determination of the adequacy of the pillars and perimeter walls of the mine to support the weight of the overlying salt and overburden;
- Determination of the adequacy of the roof spans between the pillars and the perimeter walls; and
- Identification of special problems associated with the shafts throughout their total depth, with particular reference to the shaft seals in the salt.

A mine survey of both levels of the mine indicated that although pillar decay by major slabbing, exfoliation and

ravelling had occurred and would most certainly continue, none of the pillars had failed and no major roof failures had occurred even in those parts of the mine which were worked out more than 50 years ago. Based on these observations, it was reasonable to conclude that the mine was stable and that it would remain essentially stable over the SPR design life of 40 to 50 years.

To further quantify these conclusions, two types of analyses were performed:

- (1) A stability analysis using uniform compressive stress across the pillar; and
- (2) A more rigorous analysis by the finite element method to show the distribution of the principal stresses throughout a pillar and the adjacent salt mass.

Additional study of pillar strength was done in the 1979 study by Acres. It was shown that the unconfined compressive strength of the salt was approximately 2500 psi, while the vertical stress was estimated to be approximately 1520 psi for the average 100 foot square pillar. Therefore, the average vertical stress is approximately 60 percent of the unconfined compressive strength. The size of pillars in the Weeks Island mine are large (100 x 100 feet or greater) and therefore, the core portion of the pillar is in substantial confinement, resulting in a failure stress that is substantially higher than the unconfined compressive strength.

As the pillars are continually in compression, this situation results in the ravelling and spalling of the pillars from the outside in, with maximum stress concentrations at the center of

the pillar height along their outside walls. Continued **ravelling** and spalling over time results in the pillars becoming progressively more "hourglass" shaped. Since this process is continuous, the issue of pillar stability becomes dependent on the time frame being discussed. The evaluations of the previous reports were done with respect to the design life of the oil repository of 40 to **50** years. On the basis of this time frame, and evidence in the upper level which was first mined in the early **1900's**, it was concluded that the pillars would continue to provide necessary support for the roof.

Difficulties have been encountered with pillar stability in the New Morton Mine which has been developed at approximately the **1200-foot** level. The increased stresses resulting from the greater depth have required an increase in the pillar size in that mine to ensure stability during mining operations.

6.3 - Roof Stability

Stability of the roof in mines in the Weeks Island salt is dependent on a number of factors including room height, roof span, depth of the mine, salt strength and mining techniques. Slabbing and exfoliation are the main processes through which roof decay occurs, however, the activity of these processes appears to be less intense in the roof than in the walls and pillars. Scaling activity to prepare the upper and lower level walls and floor for oil storage did not adversely affect the roofs, as they appeared generally stable during the process.

One of the main features which affects the roofs of the mines is the formation of "blowouts". These are roughly circular pockets which form abruptly during or immediately after blasting; and extend upward as sinuous, conical shaped pockets. Their size varies, but they are generally from 1 to 20 feet

deep with bases ranging to 30 feet in diameter. Larger "blow-outs" have been experienced in the 1200 foot new Morton Mine. They usually occur in the upper corners of rooms at the point where the walls and roof meet, extending upward into the roof area of the mine. The cause and mechanism for "blowouts" is still the subject of debate, and no definite cause has been identified. It is believed that they may result from the release of pressure when trapped gas pockets within the salt are tapped. Because of the potential for "blowouts", it has been the mining practice to allow adequate separation between mine levels so that any such potential events would not compromise the integrity of the roofs of the lower mine, or the floors of the upper mines.

Roof stability was reviewed in 1977 and 1979 (Acres). It was found that the roof in the two levels of the SPR mines in general showed no signs of distress or failure. The existence of "blowouts" in the roof did not appear to affect the overall roof stability in the area. Based on observed conditions, it was considered that there was little risk of collapse, other than minor roof falls or spalling, occurring in either level and that any such falls would not adversely affect the overall stability of the mine or lead to loss of oil.

6.4 - Shaft Stability

Shaft stability has always been a major concern at Weeks Island as failure of a shaft can lead to mine flooding, sealing of the mine, or in the case of the SPR, render the oil withdrawal system inoperative by either flooding or damage to the manifold room. It has long been a practice to exercise great caution with any openings that connect the salt stock with the surrounding sediments. Although the salt is relatively impervious, it is subject to extreme solutioning by ground water. Any opening, however small, that provides a path for ground water flow

through the salt, will quickly enlarge by solutioning. If such a flow path is connected to the mines, it may lead to catastrophic flooding in a short period of time. Therefore, any such openings must be properly sealed to prevent the formation of a flow path for ground water which could lead to the subsequent solutioning of the salt. Shafts are inherently such types of openings. As they are relatively large, as well as being the means of ingress and egress of personnel, equipment and product, stability of the shafts and in particular the linings and associated seals are of utmost concern to the integrity of the mining operations and the SPR.

Four shafts are associated with the mines and SPR at Weeks Island. The two newest ones were developed to serve the New Morton Mine, and extend to a depth of approximately 1200 ft. The two older shafts served the upper and lower levels of the Weeks Island mines (later to become the SPR) as well as the interim development of the Markel Mine. Of these latter two shafts, most concern regarding shaft stability has centered around the older 9 foot diameter Service Shaft constructed in 1902 (Figures 3.1, 3.2 and 3.3). In previous studies, no detailed shaft stability determinations had been made with the exception of routine visual inspections of the shafts. In 1986, studies were undertaken relating to the two shafts of the SPR with specific emphasis on the Service Shaft (PB/KBB, unpublished). These investigations included both drilling and non-destructive testing.

These investigations indicated that both the Service and Production Shafts were sunk through primarily sands and gravels as described in Section 4 of this report. Gravels in the sediments in this area were found to have permeabilities in the order of 10^{-2} cm/sec which would be sufficient to cause

significant flows should there be a failure of the shaft linings and/or the shaft seals. Any such failure would result in the flow of ground water into the shaft with the resulting **solu-**tioning of the salt and further deterioration of the lining and seals. At present, there is evidence that the ground water flow is off the dome towards the surrounding waterways as discussed in Section 4.4. Any breach of the lining or seals would result in ground water flow towards the shafts, and since the aquifer is connected to the surrounding waterways, sufficient recharge would occur to result in uncontrolled flows into the shafts. A number of recommendations were made and alternative solutions presented in Acres report on this subject (1986). The reader is referred to that report for more details regarding stability of the shafts.

7 - HAZARDS

7.1 - Introduction

This section addresses the potential impacts on the Weeks Island SPR facilities resulting from naturally occurring hazards. The major hazards which are considered to have the greatest potential impacts on the site include:

- Hurricanes and high winds; and
- Earthquakes.

These hazards are individually discussed in the following sections.

7.2 - Hurricanes and High Winds

Hurricanes passing through southern Louisiana result in high winds, heavy rains, and flooding. From 1900 to 1971, 85 storms of hurricane tropical strength have struck or threatened the coast of Louisiana. Twenty-one tropical storms crossed a **100-mile** stretch of coast in the vicinity of the site during that period (FEA, 1976). The American National Standard (ANSI, 1972) for the fastest mile of wind (30-foot level) is 95 mph for a 50-year recurrence interval and 110 mph for a **100-year** interval.

Due to the high elevation of the island (>150 feet) flooding is not considered a potential hazard.

7.3 - Earthquakes

The historical record of seismicity in the Gulf Coast indicates that the area is nearly aseismic. The largest recorded earthquake within a 200-mile radius at Weeks Island was Intensity VI (**FEA, 1976**). The epicenter of this earthquake was about 35 miles south of Baton Rouge and approximately 50 miles northeast of the island. The quake occurred in 1930 and was felt in towns as close to Weeks Island as Franklin, 17 miles to the northeast. The greatest structural damage that resulted from this earthquake was chimney and window damage at Napoleonville, 50 miles northeast of Weeks Island (**FEA, 1976**).

The Weeks Island site is located in Seismic Zone 1 (UBC, 1985) which corresponds to intensities V and VI on the Modified Mercalli scale. Earthquakes of these intensities are unlikely to cause damage to well-built structures or underground openings.

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Fenix & Scisson, Inc., As-Built Completion Report - Fill Hole No. 2; East Fill Hole - Weeks Island Complex - Strategic Petroleum Reserve, prepared for Parsons-Gilbane under Subcontract No. 286-1080-000 to U.S. Dept. of Energy Strategic Petroleum Reserve Program, 1979c.

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APPENDIX A

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APPENDIX B

DATA BASE MANAGEMENT SYSTEM FOR SALT DOME BORINGS AND REGIONAL OIL AND GAS WELLS

SUMMARY OF COMPUTER-BASED GEOLOGIC ASSESSMENT

The geologic assessment of the sediments surrounding and over the Weeks Island salt dome was accomplished by Dr. Magorian and Acres utilizing a computerized 3-D data-base and several computer programs for data analysis. The programs, which were developed by Acres on an IBM-PC, are accessed by a menu-driven system. This system is used to manage an extensive data-base and prepare contour maps and section profiles of the **strati-**graphy surrounding the Weeks Island salt dome. The maps and profiles may be transferred to Acres, Computer Aided Design and Drafting (CADD) system for plotting and, when complete, readily converted to drawings. A generalized schematic of the geologic assessment procedure is shown in Figure B.1.

The data-base for the Weeks Island salt dome geologic characterization was formulated from Dr. **Magorian's** interpretations of geophysical data from approximately 400 oil and gas exploration wells drilled around the dome during the past 60 years. These data were supplemented with logs from salt exploration borings drilled over the top of the dome by the Morton Salt Company and their predecessor, Myles Salt Company and foundation investigations for the SPR facilities and the new Morton facility. The

TABLE C.1

DEFINITION OF LEASE SYMBOLS

Table C.1 is an explanation of the lease symbols used on Figure 5.1, Regional Boring Map. The section(s) where the lease is located, owner(s) of the lease, and drill operator(s) are identified for each map symbol.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

DEFINITION OF LEASE SYMBOLS

MAP SYMBOL	OPERATOR	DEFINITION	SECTIONS
A	SHELL	WEEKS ISLAND - STATE UNIT "A"	13,14
B	SHELL	SMITH - STATE UNIT "B"	18
C	SHELL	SMITH - STATE UNIT "C"	18
D	SHELL	SMITH - STATE UNIT "D"	17,20
E	SHELL	SMITH - STATE UNIT "E"	19,20
F	SHELL	SMITH A - STATE UNIT "F"	41
G	SHELL	SMITH - STATE UNIT "G"	14
H	SHELL	SMITH - STATE UNIT "H"	14
J	EXXON	JULIET HILL PROVOST	17,42
K	EXXON	MIAMI CORPORATION	25,35,36
M	SHELL	EASEMENT AGREEMENT WITH MYLES SALT	WEEKS ISLAND
N	EXXON	MIAMI CORPORATION	35,36
U	SHELL	SMITH - STATE UNIT "T"	13
AG	SHELL	WEEKS - GALL - STATE	12,13
AW	SHELL	WEEKS GALL	12
BA	SHELL - EXXON	STATE WEEKS BAY	22,27
BB	EXXON	BURGUIERES - BENJAMIN	44
BJ	SHELL	"B" - JOHN AUGUSTINE SMITH	41
BR	MORTON SALT	BRINE CAVERNS	WEEKS ISLAND
CF	SHELL	CONTINENTAL FEE	14
CG	SHELL	SMITH - WEEKS - GALL UNIT	14
CK	SHELL - EXXON	J. A. SMITH - COCKE & GOODRICH	15,22,23
CU	SHELL	CONTINENTAL - STATE - WEEKS - GALL UNIT 1	14
CW	SHELL	CONTINENTAL - STATE - WEEKS - GALL UNIT 1	14
DR	SHELL	EDWARD S. MILLAR III - EUGENE W. PATOUT et al.	41
ET	SHELL - CONTINENTAL	EDWARD T. WEEKS et al.	11,12,13,14
GC	EXXON	GOODRICH - MIAMI CORPORATION	26
GM	SHELL - CONTINENTAL - EXXON	MIAMI CORPORATION - CONTINENTAL FEE	10,15
GP	GULF - SHELL	PROVOST CYR - STATE UNIT	19
GR	EXXON	R. H. GOODRICH et al.	22,23,26
GS	EXXON	GOODRICH - SMITH	26
GW	SHELL	WEEKS - GALL	12
HB	EXXON	J. M. BURGUIERES CO. LTD	44
HG	EXXON - CHEVRON	HUMBLE FEE - GULF	30
HH	EXXON	HORTENSE PROVOST GONSOULIN	41
HR	EXXON	RITA PROVOST MINVIELLE	41
HW	EXXON	HUMBLE FEE - WEEKS	44,45
JA	SHELL	JOHN AUGUSTINE SMITH	18

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WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

DEFINITION OF LEASE SYMBOLS

MAP SYMBOL	OPERATOR	DEFINITION	SECTIONS
JB	SHELL	JOHN AUGUSTINE SMITH	41
JD	SHELL	JOHN AUGUSTINE SMITH	31
JE	SHELL	JOHN AUGUSTINE SMITH	20
JS	SHELL	SMITH - STATE UNIT "J"	14,15
MS	EXXON	MIAMI CORPORATION - SMITH	36
MY	VARIOUS	SALTEXPORATION	WEEKS ISLAND
SB	SHELL	SHELL - BURGUIERES	
SC	SHELL	JOHN AUGUSTINE SMITH "C"	13,14
SE	SHELL	CONTINENTAL - SMITH - WEEKS - GALL UNIT 1	14
SH	SHELL	GONSQUIN - MINVIELLE	41
SK	SHELL	SMITH - STATE UNIT "K"	17,20
SM	SHELL	CONTINENTAL - SMITH - STATE UNIT 1	14
SP	SHELL	SHELL - PROVOST - STATE UNIT 1	17
ST	SHELL	CONTINENTAL - STATE UNIT 1	14
SW	SHELL	SHELL - WILLIAMS	20
WG	SHELL - CHEVRON	W. G. WEEKS	10,11
XB	EXXON	J. M. BURGUIERES CO.	20,29,31,32

TABLE C.2

SUMMARY OF WELL CONTROL

Table C.2 is a tabulation of oil and gas exploration wells in the vicinity of the Weeks Island salt dome used for this study. For each well signified by a lease symbol and well number, the following information is given:

- North and east coordinates based on the Louisiana Coordinate System (ft).
- Reference elevation in feet above Mean Sea Level.
- Total well depth in feet below the reference elevation.
- Depth to top of first salt encountered in well (if any). See Table C.3, Summary of Well Log Interpretations, for additional layers of salt.
- Date of well completion refers to the most recent logging date.
- Well status refers to the coding shown on Figure 5.1, Regional Boring Map:
 - o P = Producing oil or gas well
 - o D = Dry well
 - o A = Abandoned oil or gas well (formerly productive).

TABLE C.2 (Cont'd)

- Well orientation refers to the vertical orientation of the hole:

0 Ver - Vertical well

0 Inc - Inclined well drilled along a reasonably straight line

o Dev - An inclined well that deviates from its original line of descent

0 St - A side track well drilled from an existing well. The original hole has a standard designation; side tracks are numbered in order of drilling (i.e., ST-1, ST-2, ...)

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WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST NORTH	REFERENCE ELEVATION	TOTAL DEPTH TO	DEPTH SALT	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
A01	1848438	422276.6	19	13003	7/47	P	DE ?
A02	1847876	421475.8	19	12632	2/49	P	DEV
A03	1847764	422862.3	19	13978	6/49	P	DEV
A04	184' 90544	222813.9	19	13860	11/49	P	DEV
A05	1848917	422616.7	19	14426	11/61	P	INC
A06	1848032	421963.3	19	12840	5/50	P	DE ?
A07	1847216	421037.5	13	9596	6/50	P	DEV
A08	1847122	421331.1	19	12420	3/51	P	INC
A09	1847618	423118.7	19	14100	6/51	P	INC
A10	1's47350	421713.8	19	12542	9/51	P	DEV
A11	1847170	423181.3	35	14201	12/51	P	INC
A12	1847692	422265.9	21	13179	12/51	P	DEV
A13	1847133	422431.2	19	13800	7/54	P	DEV
A14	1846417	421142.0	19	11178	6/54	P	VER
A15	1847850	422535.0	23	14304	8/58	P	DE ?
A16	1846393	421290.6	24	13050	1/68	P	DEV
A17	1847387	421800.9	30	13150	1/78	P	INC
A18	1846393	421554.3	37	13061	1/83	P	DEV
A19	1848072	421944.5	37	11430	1/84	P	INC
A20	1848035	421964.6	37	11320	3/84	P	DEV
B01	1852362	422498.6	19	13999	12/47	P	DEV
B02	1853498	422297.7	19	14652	5/48	P	DEV
B03	1852529	421539.4	19	12954	10/48	P	DEV
B04	1853977	4229' 95 . . 3	19	14905	3/49	P	DEV
B05	1853936	420944.4	19	11946	5/49	D	DEV
B06	1853015	421950.1	19	13325	9/49	P	DEV
B07	1853937	421742.4	19	13296	1/49	P	DEV
B08	1852406	422307.5	19	13450	7/50	P	DEV
B09	1852409	422958.5	19	13817	1/51	P	DEV
B10	1853153	422388.0	20	13872	2/61	P	INC
B11	1852868	422211.2	19	13890	4/51	P	DEV
B12	1853688	421812.6	19	13950	6/51	P	DEV
B13	1852860	421703.2	20	13620	7/59	P	DEV
B14	1852939	422779.1	20	14680	11/59	P	DEV
B15	1854299	420361.1	34	8012	7/79	P	VER
B16	1852936	42' 793 . . . 1	39	15785	11/83	P	DEV
co1	1856667	419287.4	19	12032	9/48	P	DEV
co2	1854706	421415.3	19	13818	6/49	D	DEV
C03	1855955	419301.1	19	13785	11/50	P	DEV
C04	1855410	419683.4	19	12441	12/51	P	DEV
C05	1854847	422375.8	19	14468	2/52	P	DEV
C06	1854926	420047.6	19	11801	11/56	P	DEV

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C. 3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES		REFERENCE ELEVATION	TOTAL DEPTH	DEPTH TO SALT	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
	EAST	NORTH						
co7	1856247	419716.0	21	14390		2/58	P	DEV
C08	1856420	418922.0	20	14030		5/58	P	DEV
C09	1856248	420599.2	23	14424		10/58	D	DEV
C10	1855703	422594.1	21	14880		7/65	P	DEV
C11	1854117	420034.7	36	11801	2800	9/76	P	DEV
C12	1855665	421969.5	19	11520		2/46	D	INC
D01	1857602	417955.6	19	14485		7/50	D	INC
D02	1858576	418318.3	19	15590		10/54	P	INC
D03	1858995	418272.6	19	15546		8/55	P	INC
D04	1857966	419191.8	31	15365		6/79	P	DEV
D05	1857562	419187.4	41	15580		7/84	P	DEV
E01	1857838	415415.0	19	13868		6/51	P	INC
E02	1856376	414286.5	19	5888		5/60	D	VER
E03	1856678	414271.3	26	10941	5900	7/60	P	ST
E03-ST1	1856678	414271.3	26	12052		10/60	D	ST
E04	1856904	414029.2	20	13060		2/67	P	DEV
E05	1856127	413460.5	26	8117	8050	6/73	D	ST
E05-ST1	1856123	413460.5	26	11130	10560	7/73	D	ST
E06	1856955	414174.0	20	13520		3/74	D	ST
E06-ST1	1856955	414174.0	20	120%		5/74	D	ST
F01	1854790	424356.5	19	15346		4/52	P	INC
F02	1854829	424703.3	25	15752		11/60	P	DEV
F03	1856140	424835.5	26	16725		3/77	P	VER
G01	1845369	421534.1	13	11478	10270	1/54	P	VER
G02	1846195	422272.1	18	13712		10/54	P	DEV
G03	1845174	422173.9	22	13437		6/74	P	DEV
G04	1845175	422169.0	33	13441		9/83	P	DEV
H01	1844455	420624.7	19	11642		1/53	P	INC
H02	1844764	420335.7	19	11080		6/53	P	INC
H03	1845399	420565.5	19	9792		9/53	D	VER
H04	1844134	420941.6	17	10845		3/54	P	VER
H05	1845237	420746.5	19	11275		4/55	P	VER
H06	1844480	420850.2	31	10866		11/67	D	ST
H06-ST1	1844480	420850.2	31	11552		11/67	P	ST
H07	1845710	420160.3	28	1959		7/72	D	VER
H08	1845698	420162.4	28	7557	2480	8/72	D	INC
J01	1857651	427323.4	19	17783		2/55	P	DEV
J02	1857626	425963.2	19	17458		8/55	D	INC
J03	1858067	421708.3	28	15775		12/61	D	VER
J04	1857742	424776.6	30	17400		9/62	P	DEV
J05	1359804	423994.0	27	17794		11/63	P	DEV
J06	1857745	422140.6	25	15976		3/64	D	INC

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST NORTH		REFERENCE ELEVATION	TOTAL DEPTH TO	DEPTH SALT	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
J07	1862161	421833.2	23	18568		7/64	D	INC
J08	1862155	421934.3	24	18996		2/65	P	DEV
K01	1850320	410148.9	13	9327		1/50	D	ST
K01-ST1	1850320	410148.9	13	9558		2/50	D	ST
K02	1851114	408638.7	19	12858		9/52	A	DEV
K03	1850023	408601.3	19	12622		1/53	D	DEV
K04	1851552	407647.6	19	13244		8/54	P	INC
K05	1848222	408039.3	20	12978		1/58	A	DEV
K06	1849625	409319.6	35	12150		6/61	D	VER
K07	1848223	409058.4	21	12192		4/62	A	INC
K08	1851757	408977.5	23	12500		11/65	A	DEV
K09	1847443	408778.5	21	12390		11/66	D	DEV
M01	1849837	421842.5	14	11980		9/46	P	INC
M02	1849111	421754.1	19	12473		11/47	P	DEV
M03	1851356	421464.9	19	12561		7/48	P	INC
M04	1852443	420820.5	19	10899	1720	5/49	P	DEV
M05	1852213	421085.5	19	12252	5500	7/50	D	ST
M05-ST1	1852213	421085.5	19	11580		11/50	P	ST
M06	1852349	421204.6	19	12552		5/51	P	INC
M07	1855604	419197.1	19	11623	2780	4/51	P	INC
M08	1848815	421439.3	19	11985	2830	9/51	P	INC
M09	1848871	421378.4	13	2402		9/51	P	VER
M10	1853065	420735.6	19	10452	2390	1/52	D	ST
M10-ST1	1853065	420735.6	19	12503	10260	3/52	P	ST
M11	1855240	419402.4	19	11743	1808	10/52	P	DEV
M12	1851416	421303.2	19	12103		7/52	P	DEV
M13	1850434	421227.9	19	12208	2390	1/53	P	DEV
M14	1849976	421036.9	15	12096	1470	7/54	P	INC
M15	1849018	421715.8	18	11150		9/54	P	VER
M16	1854531	411768.3	19	11991	1750	4/57	D	DEV
M17	1850167	411912.3	13	3033	1250	12/55	D	DEV
M18	1854165	413321.2	13	2521	1270	1/56	D	VER
M19	1852359	412126.5	39	2576	1500	12/55	D	INC
M20	1851572	421523.8	23	13142		5/59	P	DEV
M21	1850046	421894.8	26	13203		8/59	P	DEV
M22	1850201	421493.3	22	12423	2760	11/59	P	DEV
M23	1851280	421565.3	31	11617		11/66	P	DEV
M24	1850111	421482.6	23	11764		2/67	P	INC
M25	1851246	421803.4	20	12447		2/69	P	DEV
M26	1852337	421224.1	37	13755		1/84	P	DEV
M27	1850190	422055.5	23	10665		12/84	P	DEV
N01	1846961	405285.5	23	14205		2/58	D	VER

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST	REFERENCE TOTAL NORTH ELEVATION	DEPTH DEPTH TO SAL?	DATE COMPLETED	WELL STATUS	WELL ORIENTATION	
U01	184'1746	422681.0	13	14026	3/45	P	DEV
U02	1849736	423056.3	19	14301	3/46	P	INC
U03	1851086	423101.9	13	14395	3/47	P	DEV
U04	1850'384	422229.4	19	13058	11/47	P	DEV
U05	1850569	422720.4	19	13576	9/49	P	DEV
U06	1849915	423764.3	19	14351	12/49	P	DEV
U07	1851550	422705.6	19	13856	3/50	P	DEV
U08	1850910	433110.3	33	15355	1/60	P	DEV
U09	1851762	423023.0	19	14088	9/51	P	INC
U10	1850505	422601.5	23	14400	5/59	P	DEV
U11	1849763	423034.4	27	14004	5/65	P	DEV
U12	1850793	423474.3	26	14235	5/80	P	VER
AG01	1851081	424451.6	19	15501	12/49	P	INC
AG02	1851118	425387.2	27	15234	5/50	P	INC
AG03	1849591	424421.1	19	15916	7/49	P	INC
AW01	1850593	425820.9	19	15343	10/51	P	DEV
AW02	1849279	425922.6	23	15823	12/58	P	INC
AW03	1849276	425301.3	18	15329	1/52	P	INC
BA01	1842503	416528.4	13	10934	5/47	D	DEV
BA02	1843522	416525.3	13	9450	8/47	A	INC
BA03	184-418	415741.8	13	10002	3/48	P	DEV
BA04	1843324	414138.2	13	3143	1/49	P	DEV
BA05	1843716	415821.0	13	9251	8/48	P	INC
BA06	1843757	414250.6	13	9623	5/49	P	INC
BA07	1844259	413623.5	13	5352	7/49	P	INC
BA08	1844492	413094.9	13	9497	11/49	P	INC
BA09	1843535	417190.2	13	9482	1/50	D	INC
BA10	1844854	412405.9	13	9205	8/50	P	INC
BA11	1845068	412212.9	13	9048	10/50	P	DEV
BA13	1843214	413834.4	25	10248	5/54	D	VER
BA14	1843655	415481.4	25	9251	3/57	P	INC
BA15	1844247	414031.9	25	8998	5/57	P	INC
BA16	1844495	413509.5	25	8986	7/57	P	DEV
BA17	1842883	410304.1	25	14780	1/60	D	VER
BA18	1843818	416484.2	18	3837	5/65	D	VER
BA19	1843335	417167.7	25	9487	12/75	P	VER
BA20	1843085	416842.5	22	9876	4/76	D	DEV
BA21	1843561	417643.6	26	9676	3/76	P	DEV
BA22	1843281	418176.5	26	10618	9/76	P	DEV
BA23	15' 43072	417352.4	26	10502	3/77	P	DEV
BA24	1844031	412289.0	26	10023	8/77	D	ST
BA24-ST1	1844031	412289.0	26	105136	9/77	D	ST

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST NORTH		REFERENCE ELEVATION	TOTAL DEPTH TO SALT	DEPTH	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
BB01	1851769	410945.3	19	6002		10/51	A	INC
BB02	1851335	411076.1	23	4484	4347	1/71	D	VER
BJ01	1846073	421083.2	19	11215	9520	12/54	P	INC
BJ02	1845896	421420.5	19	11395	10160	11/53	P	VER
BR01	1852293	419253.0	35	1268		11/86	D	VER
BR02	1852288	418598.8	25	1510		6/78	D	VER
CF01	1844287	422649.2	19.45	13769		4/63	P	INC
CG01	1848615	423984.4	19	14458		4/53	P	DEV
CG02	1848229	423107.4	19	14436		3/56	A	DEV
CK01	1842406	420522.9	22	11736		4/52	P	INC
CK02	1843279	420140.3	19	11448		3/53	P	DEV
CK03	1844134	419860.6	13	10766		9/53	P	INC
CK04	1843078	419296.2	21	10788		3/67	P	INC
CK05	1844611	419081.8	23	8503		7/72	D	INC
CK06	1843078	419256.2	32	10333		3/79	P	DEV
CK09	1844408	419128.5	40.5	10875		1/85	P	VER
CU01	1843746	423923.7	33	14546		10/54	P	VER
CW01	1845416	423941.0	19	14445		10/53	P	INC
cwo2	1844647	423936.4	19	14433		1/54	P	VER
DR01	1852382	428328.5	19	17669		5/55	A	INC
DR02	1854763	429582.1	36	19444		8/84	A	VER
ET01	1847936	425734.2	21	15345		7/52	P	INC
ET02	1847471	424234.7	19	14472		10/52	P	INC
ET03	1846676	425403.7	19	15177		1/53	P	INC
ET04	1845318	425815.0	19	15261		4/53	P	INC
ET05	1843936	425838.2	19	15340		2/55	P	VER
ET06	1846807	426101.9	22	15915		10/59	P	DEV
ET07	1848045	425957.3	18	15940		7/59	P	DEV
ET08	1848416	424993.1	21	16381		10/56	D	INC
ET09	1848610	425646.1	19	16700		2/57	P	DEV
ET10	1853797	426212.8	21	15816		3/60	P	DEV
ET11	1849045	424257.5	19	14478		6/52	P	DEV
ET12	1849205	423751.2	19	14402		11/54	P	INC
GC02	1847607	410035.7	18	10750		8/62	P	DEV
GM01	1842879	424088.2	19	14622		10/57	A	VER
GP01	1856631	417984.5	19	13755		9/49	D	DEV
GP02	1856610	417424.4	19	11074	5120	9/50	D	ST
GP02-ST1	1856610	417424.4	19	11600		11/50	P	ST
GP03	1856264	418345.6	19	11998		5/51	P	DEV
GP04	1856811	416788.2	19	10364	5850	9/51	D	ST
GP04-ST1	1856811	416788.2	19	11150		9/51	D	ST
GP05	1856302	417986.4	19	11557	2620	9/52	P	ST

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST NORTH		REFERENCE ELEVATION	TOTAL DEPTH TO SALT	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
GP05-ST1	1856302	417986.4	19	10744	12/52	P	ST
GP06	1856521	418339.5	21	13576	10/58	P	DE?
GP07	1856629	418349.4	21	14095	6/59	P	DEV
GP08	1856910	415103.3	25	13528	2/60	P	ST
GP08-ST1	1856910	415103.3	25	12027	12/73	P	ST
GR01	1844448	416534.9	13	5487	11/47	D	INC
GR03	1844177	415705.4	13	8350	3/48	P	DEV
GR05	1843738	418243.1	13	3159	7/48	D	ST
GR05-ST1	1843738	418243.1	13	8551	9/48	D	ST
GR06	1843969	414997.2	13	8900	10/48	P	INC
GR07	1843916	418032.5	13	8591	12/48	D	INC
GR08	1845094	413195.8	13	8257	5/49	D	ST
GR08-ST1	1845094	413195.8	13	8489	6/49	D	ST
GR09	1844483	414505.5	13	8304	11/49	D	ST
GR09-ST1	1844483	414505.5	13	9018	12/48	P	ST
GR10	1844772	413091.6	13	8850	4/50	P	INC
GR11	1844951	412622.1	13	9058	4/50	P	DEV
GR12	1845438	412180.4	13	8528	5/50	D	ST
GR12-ST1	1845438	412180.4	13	9065	6/50	P	ST
GR13	1845634	411431.4	13	8946	9/50	A	DE?
GR14	1844878	413876.2	13	8300	9/50	D	DEV
GR15	1846133	411039.8	13	9506	2/51	D	ST
GR15-ST1	1846133	411031.8	13	9162	3/51	P	ST
GR16	1844827	415830.1	13	5185	4/52	D	ST
GR16-ST1	1844827	415830.1	13	7962	5/52	P	ST
GR17	1844607	415154.3	13	8054	11/52	D	INC
GR18	1844827	417795.0	13	3498	9/52	A	VER
GR13	1846000	412021.4	13	5704	11/52	D	ST
GR19-ST1	1846000	412021.4	13	8745	2/53	A	ST
GR20	1846391	409507.0	13	11586	10/53	D	INC
GR21	1844074	415359.4	24	9192	7/57	P	DEV
GR23	1844800	413341.5	22	3808	9/57	P	DEV
GR24	1843938	417711.9	20	8436	1/61	P	DEV
GR25	1844007	414798.6	27	9099	1/76	P	ST
GR25-ST1	1844007	414798.6	27	9004	2/76	P	ST
GR26	1845352	411736.4	27	9676	12/76	D	DEV
GS01	1848024	411020.0	32	7112	6/64	D	DEV
GW01	1850612	426907.6	18	17183	2/53	P	DEV
GW02	1850908	427991.8	22	17009	7/60	A	INC
HB01	1853504	410069.7	13	10275	8/46	D	INC
HB02	1853680	409442.5	19	12543	1/47	D	INC
HB03	1854615	409096.9	13	12368	8/47	A	DEV

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL	COORDINATES		REFERENCE	TOTAL	DEPTH	DATE	WELL	WELL
NUMBER	EAST	NORTH	ELEVATION	DEPTH To	SALT	COMPLETED	STATUS	ORIENTATION
HB04	1855078	408670.5	13	13604		5/48	D	INC
HB05	1853287	411369.1	13	7723	7535	6/49	A	INC
HB06	1852635	411152.3	13	5692	5570	10/49	P	INC
HB07	1852085	410809.7	13	7495	7475	11/49	D	INC
HB08	1852076	411030.8	13	5638		1/50	A	INC
HB09	1853635	410844.5	19	10183		7/50	D	INC
HB10	1854002	40Y623.3	19	11853		11/50	D	INC
HB11	1854834	409808.7	19	13509		9/51	A	INC
HB12	1854615	409097.9	19	12622		12/52	A	DE!
HB13	1853939	409311.4	19	11511		4/53	A	ST
HB13-ST1	1853939	409311.4	19	13081		6/53	D	ST
HB13-ST2	1853939	409311.4	19	12250		12/53	D	ST
HB14	1853322	409956.8	23	11759		12/61	P	DEV
HB15	1853468	410343.7	27	10440		2/79	D	DEV
HB16	1853201	411525.9	31.3	5320	5305	7/82	D	ST
HB16-ST1	15'53201	411525.Y	31.3	5686	5655	7/82	D	ST
HG01	1853507	408286.7	19	13392		11/47	P	DEV
HG02	1852601	408719.4	19	12880		3/52	A	DEV
HG03	1853237	408997.6	20	13033		4/54	D	ST
HG03-ST1	1853237	408997.6	20	11403		10/66	A	ST
HG04	1855668	412963.1	21	10407	10350	2/61	A	ST
HG04-ST1	1855668	412963.1	21	11420	10460	4/61	D	ST
HG05	1856173	412959.7	21	13300		8/61	A	DEV
HG06	1852551	409519.4	21	11992		5/61	P	INC
HG07	1852454	409291.5	26	11975		4/66	A	DEV
HG08	1852567	409881.4	22	10322		10/66	D	INC
HH01	1855003	425611.8	19	17334		3/53	P	DEV
HH02	1856287	426016.0	19	16891		5/55	P	DEV
HR01	1855197	427298.2	19	17644		5/54	A	INC
HR02	1856297	427304.9	19	17666		Y/54	P	INC
HW01	1855658	410042.1	13	14012		4/49	D	INC
HW02	1853705	411880.5	19.3	6100	5060	8/49	A	INC
HW03	1854608	410807.9	19	10603		5/51	D	ST
HW03-ST1	1854608	410807.9	19	11210		6/51	A	ST
HW04	1853859	411868.9	13	5848		3/52	A	INC
HW05	1855642	411983.1	21	10734		10/61	D	ST
HW05-ST1	1855642	411983.1	21	13881		3/62	A	ST
HW06	1854022	411601.3	17	7843	7798	6/63	A	INC
JA01	1854773	423002.1	19	15084		10/48	P	INC
JA02	1855257	423651.1	19	15307		2/59	P	DEV
JA03	1856191	423602.6	25	15814		2/63	P	DEV
JB01	1853507	424993.1	19	15344		11/51	P	INC

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SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL CONTROL

MAP WELL NUMBER	COORDINATES EAST	REFERENCE NORTH	TOTAL ELEVATION	DEPTH TO SALT	DATE COMPLETED	WELL STATUS	WELL ORIENTATION
JB02	1851975	425004.9	19	16831	6/57	P	INC
JD01	1852312	407614.6	19	13840	4/54	A	INC
JD02	1853619	406309.6	19	14915	2/55	D	INC
JE01	1861949	417924.4	20	17722	8/56	D	INC
JS01	1844119	420523.0	14	10900	8/53	P	INC
MS01	1851186	410822.9	13	7300	4/51	A	INC
MS02	1850586	410842.5	13	5929	12/51	A	INC
MS03	1849946	411009.5	13	5852	2/52	D	ST
MS03-ST1	1849946	411009.5	13	5839	3/52	A	ST
MS04	1849298	410907.4	13	5585	5/52	D	DEV
MS06	1849155	410786.7	28	5519	9/79	D	INC
MY01-MY137	* - SEE TABLE C.2A						
SB01	1856785	404046.2	19	15488	3/57	A	DEV
SC01	1849194	423348.3	19	14144	8/52	P	INC
SC02	1848264	423295.2	19	14150	3/53	P	INC
SG01	1846214	423897.5	19	14433	8/53	P	INC
SG02	1846852	423932.0	28	14418	6/53	P	INC
SG03	1846005	423362.3	14	14407	2/56	P	DEV
SG04	1846762	424241.9	19	15217	6/62	P	DEV
SG05	1846760	424244.8	40	15756	5/84	P	INC
SH01	1852275	425810.5	19	16640	6/51	P	INC
SH02	1853568	426913.8	19	18469	9/53	A	DEV
SH03	1853776	427678.4	19	16954	10/54	P	DEV
SH04	1852479	426186.8	17	17068	2/62	P	DEV
SK01	1858926	419980.6	19	15941	2/55	P	DEV
SM01	1846244	423031.2	17	14235	6/53	P	INC
SM02	1846213	422663.7	19	13598	10/53	P	DEV
SM03	1845961	423048.4	19	14127	5/56	P	INC
SP01	1857594	420333.4	19	15201	10/53	P	INC
SP02	1859023	420653.1	19	16077	2/54	D	INC
SP03	1858306	420402.1	25	15553	6/62	P	DEV
ST01	1845563	422903.0	13	14148	12/53	P	DEV
SW01	1860326	415048.6	19	15841	6/52	D	INC
WG01	1847782	428005.3	19	17786	7/54	P	INC
WG02	1848303	430003.5	27	20430	5/73	A	INC
WG03	1848266	428370.8	20	16987	10/61	P	DEV
WG04	1846828	428568.3	25	17247	9/67	D	DEV
WG05	1842810	425945.5	19	15742	11/55	D	VER
WG06	1844519	429998.5	27	17581	1/65	D	VER
XB02	1861899	408745.5	24	17311	7/67	D	INC
XB03	1855253	406911.4	23	14994	10/69	D	DEV

GEOLOGICAL CORRELATIONS MADE FROM ELECTRIC LOGS; SEE TABLE C.3 FOR LOG INTERPRETATIONS

TABLE C.3

SUMMARY OF WELL LOG INTERPRETATIONS

Table C.3 defines geologic interpretations of electrical logs for wells listed in Table C.2, Summary of Well Control. The depths to each stratigraphic unit are measured in feet below the well reference elevation (REF. EL). The stratigraphic symbols are defined in Sections 4.3 and 5.2 and summarized on Table 5.1. The following additional symbols are used:

- **870F60:** At 870 ft below the reference elevation, the well intersects a fault with 60 ft throw, as interpreted from correlation with nearby wells.
- **9250MN:** At 9250 ft below the reference elevation, the well encounters mineralization.
- **2780TS:** At 2780 ft below the reference elevation, the well enters salt (Top-of-Salt).
- **3410BS:** At 3410 ft below the reference elevation, the well exits salt (Bottom of Salt).
- **14420Pr:** At 14420 ft below the reference elevation, the well encounters over-pressurized shale.

At the bottom of each column, the measured total depth (TD) of each well is given in feet below reference elevation.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	A01 19	A02 19	A03 19	A04 19	A05 19	A06 19	A07 13	A08 19
SYMBOL								
TL	120	122	119	120	121	108	121	122
CS			180	160		160		
CC			175	215		190		
WI	225	225	240	260	240	230	230	220
2C	360	350	360	375	370	355	350	350
A	550	530	575	565	560	555	510	530
								870F60
S	950	755	900	880	830	880	760	
I	1085	985	1115	1110	1100	1080	930	1020
P	1260	1100	1290	1300	1300	1235	1060	1160
KA	1845	1620	1955	1650	2155	1820	1740	1825
NE	2130	2080	2170	2145	2340	2200	2090	2145
TP	2885	2690	2960	2940	2940	2720	2670	2660
MP	4300		3300	3260	3280	3200		
MID	5820	5700	5905	5880	5870	5785	5265	5360
L	7070	6650	6430	7255	7225	6920	h050	6710
		6920F1500						7030F700
2L	8860	8320	8380	8950	8925	8785	7675	8090
2	9550	9010	9670	9660	9630	9490	8585	
							9250MN	
W	10235	10035	10410	10410	10375	10215		9310
								9440MN
								9660MN
BH	10780	10710	10940	10920	10885	10705		10350
CI	11020	11215	11180	11190	11140	10920		10950
co	12070	11600	12475	12420	12330	11920		11445
		12235MN						
		12400MN						
AB	12810	12540		13320		12750		12205
TD	13003	12632	13978	13860	14426	12840	9596	12420

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	A09 19	A10 19	A11 35	A12 21	A13 19	A14 19	A15 23	A16 24
SYMBOL								
TL	121	122	173	141	120	120	2536	2496
cs				150				
cc				190				
WI	240	230	260	230	250	220		
2c	370	365	380	360	370	350		
A	570	560	600	560	570	540		
S	820	860	920	890	880	790		
I	1120	1075	1160	1110	1120	1030		
P	1295	1210	1290	1240	1250	1170		
KA	1890	1820	1930	1855	1940	1755		
NE	2195	2170	2200	2215	2255	2280		
TP	2970	2690	3000	2760	2935	2640		2850
MP	3300	3400	3710		3630			
MIO		5770	5835	5850	5865	5340	5880	5405
L	7150	6830	7545	7090	7175	6480	7190	6830
2L	9010	8440	9030	8865	8890	8250	8925	8390
2	9700	9325	9740	9560	9575	8945	9640	9090
						9080F250		
W	10450	10100	10480	10290	10305	9470	1030	10000
						9700MN		
						9850MN		
BH	10980	10780	11275	11015	10820		10890	10650
		10915F350						
CI	11230		11995	11655		10830	11105	11010
CO	11930	11700	12650	12140	12210		12300	12705
AB	13610	12400	13630	13080				
TD	14100	12542	14201	13179	13800	11178	14304	13050

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL	NAME	A1:	A18	A19	A20	B01	B02	B03	B04
REF. EL.		30	37	37	37	19	19	19	19
=====									
SYMBOL									
TL		8000	2498	4492	2512	124	149	120	123
CS						160	155		
CC						185	185		
WI						250	240	220	220
2C						480	435	470	390
A						600	600	575	590
S						880	885	850	895
I						1180	1190	1120	1180
P						1410	1355	1350	1350
KA						1860	1840	1795	1830
NE						2150	2155	2160	2235
TP		2730	2760			2830	2885	2790	2920
MIO		5430	5470	5750	5610	5910	5940	5760	5990
L		7030	6940		6500	8550	8580	8310	8650
						8800F750			
2L		8625	8580	7930	7785		9375	8620	9430
2		9405	9305	8500	9415	9480	10290	9505	10275
				9250MN					
				9785MN					
W		10155	10095	9990	10100	10390	11180	10230	11240
					10650F300				
BH		10655	10565	10510		10850	11660	10695	11740
CI		10855	10760	10785	10710	11170	11930	10930	12215
B5						11910	12400	11500	12600
co		12655	11775			12450	12684	11950	13280
AB						13430	13690		13690
R43									14110
OP									14600
TD		13150	13061	11430	11320	139'99	14652	12954	14905

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. Et.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	B05	B06	B07	B08	B09	B10	B11	B12
REF. EL.	19	19	19	19	19	20	19	19
SYMBOL								
TL	118	860	119	122	122	122	120	450
CS							150	
CC							180	
WI	230		225	230	230	240	230	230
2c	475		370	465	470	460	465	390
A	575		585	600	600	600	600	600
s	875	900	880	865	880	560	870	880
I	1055	1165	1165	1160	1170	1175	1185	1175
P	1280	1405	1350	1440	1420	1390	1410	1340
KA	1790	1830	1875	1840	1870	1845	1840	1860
NE	2210	2260	2295	2135	2285	2150	2130	2275
TP	2668	2860	2890	2865	2105	2880	2880	2880
MP						4875		
MI0	5750	5360	5940	5890	5950	5975	5900	5910
L	7650		8550	8490		5415	8520	
2L	9060	9210	9260	8730	8860	9340	10145	9290
2	9905	10050	10060	9260	9420	10400	10860	10105
W	10840	10950	11050	10350	10430	11210	11860	11080
BH	11455	11455	11650	10840	10950	11750	12155	
CI	11860	11780	12020	11110	11240	11900	12340	11910
B5		12095	12420	11720	11940	12310	13030	12230
C0		12290	12600	12290	12650	12520	13530	12500
AB		12850		13340	13380	13205		13190
R43		13210			13700	13480		13590
TD	11946	13325	13216	13450	13817	13872	13890	13950

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	B13 20	B14 20	B15 34	B16 39	co1 19	co2 19	co3 19	co4 19
SYMBOL								
TL	2522	2513	833	2540	121	9510	214	116
WI					230			210
2C					350		340	380
A					570		540	535
S					830		790	800
I			920		1100		1050	970
P			1080		1460		1290	1170
KA			1330		1850		1750	1665
NE			1750		2260		2100	2050
TP	2820	2890	2280	2940	2815		2755	2710
			2780TS					
			3410BS					
			3610TS					
			3750BS					
			4975TS					
			5373MN					
			5730MN					
			7480MN					
MID	5825	5940		5570	5730		5630	5570
L					7390		8120	8105
2L	9145			8890	9120		8960	9035
2	9960			9440	9970	10060	9810	9790
W	10780	10455		10500	10780	11100	10620	10700
BH	11375	11200		1121s	11425	11800	11210	11160
CI	11660	11490		11510	11655	12130	11480	11400
B5	11985	12080		12040		12705	12190	11750
CO	12140	12640		12630		13350	12650	12170
				12950F700				
AB	12730	13380				13730	13320	
R43	13100	13720					13540	
OP		14300		13400				
CII				13920				
MA				14885				
SD				15630				
TD	13620	14680	8012	15785	12032	13818	13785	12441

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	C05	C06	C07	C08	C09	C10	C11	C12
REF. EL.	19	19	21	20	23	21	36	19
=====								
SYMBOL								
TL	120	120	2516	2528	2500	2512	856	110
WI	220	210						220
2c	370	405						370
A	590	530						630
S	910	790						890
		870F300						
I	1170							1180
P	1360	1130					1140	1510
KA	1895	1525					1550	1880
NE	2280	1840					1820	2315
		2755TS					2800TS	
		3220BS					3210BS	
TP	2905		2850	2800	2970	3000		2920
HP								3250
M10	5995		5750	5680	5830	5980		
L	8580		7400	7380	8390	7555	7315	7270
2L	9370	8980	9200	9060	9320	5380	9100	9345
2	10250	9675	10005	9835	10150	10230	9740	10200
			10710F200					
W	11230	10555	10800	10750	11045	11230	10530	11240
BH	11890	11180	11420	11310	11620	11910	11160	
CI	12200	11500	11755	11590	11935	12260	11430	
B5	12730		125' 90	12280	12365	12750		
				12740F200				
co	13330		13330		12970	13575		
AB	13720		14020	13550	13325	13990		
R43	14230			13940	13690			
OP					14160			
					14420Pr			
TD	14468	11801	14390	14030	14424	14880	11801	11520

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	D01 15	D02 15	D03 15	D04 31	D05 41	E01 15	E02 15
=====							
SYMBOL							
TL	120	120	3551	2572	3012	120	140
cs	160						
cc	150						
WI	240	210				200	200
2c	34s	350				34s	37s
A	580	625				540	540
S	870	895				870	770
I	1220	1230				1035	980
P	1350	1370				1315	1245
KA	1870	1860				1770	1700
NE	2155	2225				2050	2030
TP	2875	2500				2750	2620
MP	4290	4260	4250			4020	3100
MIO	5600	5670	5700	5830	5825	5520	5050
L		8215		8380	8380	7665	
2L	5085	5210	523s	5320	5320	8860	
			9980F130				
2	9945	10070	10100	10060	10060	5685	
	10760F100						
W	10750	11060	11140	10980	10850	10720	
		11580F100					
BH	1141s		11650	11680	11685	11320	
CI	11650	11800	1153s	12020	12005	11675	
B5	12050	12255	12330	12440	12450	12010	
co	12635	12530	13050	12665	12650	12665	
AB	13365	13370	13500	13250	13215	13010	
R43	13740	1371s	13880	13595	13585		
OP	14280	14485	14650	14340	14390		
CII		14530	15160	14765	14875		
CA		15270	15505		15520		
SD						13820	
TD	14485	15550	15556	15365	15580	13868	5888

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	E03	E03-ST1	E04	E05	E05-ST1	E06	E06-ST1	F01
REF. EL.	26	26	20	26	26	20	20	19
-----6-----								
SYMBOL								
TL	130	8920	3012	3032	8500	3002	8500	117
WI	200							250
2C	360							380
A	550							630
S	780							905
I	1005							1190
P	1270							1380
KA	1720							1880
NE	2060							2260
TP	2760							2820
MP	3180		3245	3200		3260		4385
MIO	5260		5380	5260		5420		5920
	5500TS			8050TS				
	6180BS							
L			7810			7165		8400
2L	8540		8705		8630	8720		9475
2	9280	3340	9550		9360	9750	9740	10335
	9550F250				10560TS			
W	9860	10000	10450			10570	10540	11365
	10620TS							11770F1100
	10772BS							
	10800TS							
BH		11320	11000			11165	11070	
CI			11790			11560		
B5			12160			11960		
CO			12570			12390		12410
AB						12870		12965
R43								13370
OP								14150
CII								14725
CA								15210
TD	1094	12052	13060	8117	11130	13520	12096	15346

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	F02	F03	G01	G02	G03	G04	H01	H02
REF. EL.	25	26	13	18	22	33	19	19
=====								
SYMBOL								
TL	3043	3006	120	140	3011	3056	121	117
WI			220	230			220	230
2c			360	370			360	350
							570F50	
A			565	580				590
S			930	840			740	800
I			1105	1130			1055	1040
P			1250	1250			1275	1260
KA			1880	1910			1780	1630
NE			2240	2250			2215	2290
TP			2770	2800			2740	2660
MP			4390	3640			3570	3395
MIO	5935	5890	5470	5530	5530	5530	5390	5345
								G00F150
L	8690	8315	7090	8080	7250	8020	6985	
2L	9490	9400	8710	8850	8880	8890	8490	8290
2	10340	10255	9395	9555	9550	9565	9165	8990
W	11330	11300	10100	10270	10255	10280	9820	9580
		11820F700	10270MN					
			10370MN					
BH	11805		10810	10775			10325	
	11830F500							
CI			11450			11030	10480	
BS		12020						
co		12590		12200		11725		
AB	13010	13070		13525	13120	13240		
R43	13425	13470						
OP	14205	14310						
CII	14805	14945						
CA	15285	15330						
HA		15810						
SD		16430						
TD	15752	16725	11478	13712	13437	13441	11642	11080

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	H03 19	H04 19	H05 15	H06 31	H06-ST1 31	H07 28	H08 28	J01 19
=====								
SYMBOL								
TL	120	120	120	2004	9850	167	250	4447
WI	220	220	220					
2c	440	530	435			370	360	
		550F50						
A	550		550			540	535	
S	895	550	900			810	805	
I	1090	1120	1100			1030	1020	
P	1200	1245	1215			1130	1130	
KA	1770	1840	1810				1590	
NE	2235	2305	2290	2310			2080	
							2480TS	
							3640BS	
TP	2665	2750	2710	2760				
MP		3575	3505					
MIO	5330		5380	5420			5290	5780
L	6750	7140	6850	7040				8285
	7420F450		7350F100					
2L	8120	8545	8360	8550				9180
2	8770	3240	5050	9210				10050
	9000F300							
W	9240	9910	9770		9875			11045
	9310MN		9860MN					
			10110MN					
BH		10620	10380		10410			11745
CI			10925		11100			12170
								12710F500
AB								13160
R43								13705
OP								14480
CII								15170
MA								16120
SD								16830
TD	9772	10845	11275	10666	11552	1959	7557	17783

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	J02	J03	J04	J05	J06	J07	J08
REF. EL.	19	28	30	27	25	23	24
=====							
SYMBOL							
TL	3042	3013	3165	2950	1759	3029	4610 5510F100
KA					1900		
NE					2255		
TP					2970		
HP	3870	3610		3645	3700	3720 5500F100	
MIO	5810	5865	5955	5890	5860	5800	5810
L	8350	7510	8410	7420	7530	7500	7300
2L	3250	3480	9320	9240	9340	9315	9810
2	10305	10210	10160	10110	10180	10170	10380
W	11140	11170	11180	11085	11180	11265	11225
BH	11835	11835	118%	11760	11920	11960	11940
CI	12300	12170	12310	12220	12280	12340	12390
B5	12800	12710	12810	12670	12715	12965	12870
	12990F500		13300F750			13230F300	
co		13450		13530	13560	13440	13625
AB	13150	13930		1407s	14065	13935	14305
					14320F1300		
R43	13890	14130	13760	14430		14190	14635
OP	14530	15155	14420	14480		15390	15350
CII	15040	15760	14970	16000		15800	16150
CA				16200		16750	16730
MA	16010		15980	16490	14925	17370	17340
SD	16715		16610	17030	15795	17945	18150
				17765Pr	15930Pr	18370Pr	18310Pr
TD	17458	15775	17400	17714	15976	18568	18996

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	K01 13	K01-ST1 13	K02 19	K03 19	K04 19	K05 20	K06 35	K07 21
SYMBOL								
TL	121	7750	127	175	2725	1809	2569	1797
CS			205					
CC	150		235					
WI	220		250	270				
				410F130				
2C	435		410					
A	570		580	540				
S	815		865	742				
I	1040		1060	980				
P	1285		1300	1240				
KA	1670		1670	1700				
NE	2090		2140	2110				
TP	2710		2780	2805			2785	2785
MP	3450		3235	3330				
MIO	4140		4265	4265	4330		4245	4290
	6380F1000							
L				7340	7760	7320		
2L	8090	8115	8490	5435	8680	8430	8235	8290
2	8750	8650	9350	9230	9575	9280	9065	9100
		9195MN				9915F250		
W		9515	10190	10070	10460		9855	9870
BH			10645	10530	10960	10400	10280	10200
					11100F350			
CI			11300	11210	11180	11250	10920	10905
B5				11610	11550	11630	11305	11530
co			11780	12160	11770	12220	11750	12050
			12590Pr	12580Pr		12830Pr	12100Pr	12100Pr
AB					12350			
R43					12750			
TD	9327	9558	12858	12622	13244	12978	12150	12192

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

NELL	NAME	K08	K09	M01	M02	M03	M04	M05	M05-ST1
REF. EL.		23	21	19	15	19	19	19	19
=====									
SYMBOL									
TL	1996	200	104	122	120	121	120	9189	
CS			150						
cc			175						
WI			270	275	215	180	190		
2c			380	350	455	400	450		
A			525	540	560	570	500		
S			925	880	850	700	760		
I			1030	995	1010	785	950		
P			1320	1280	1310	1160			
				1650F400					
KA			1660		1680	1320	1510		
						1720TS			
NE	2140		2110	1860	2100		1980		
TP	2780		2745	2520	2715		2570		
						5165BS	5500TS		
						5310TS	5590MN		
							6010MN		
							6070MN		
							6230MN		
							6280MN		
MP			3330	3595	3310				
M10	4260		6140	5725	5700				
L		7100	6990	6840	6950				
2L	8500	8315	8735	8625	8720		7880		
						8720BS			
						9160TS	7900HN		
						932583	8170MN		
2	9360	9100	9455	9420	9450		9205		
W	10200	9860	10180	10140	10155	9930	10030	10030	
BH	10640	10330	10640	10625	10850	10800	10920	10510	
CI	11250	10570		10825	11240	11010	11800	10950	
	11540F60								
B5	11630	11000				11370			
co	12200	11495		10650		11750			
	12430Pr	12325Pr							
AB				12370					
TD	12500	12390	11980	12473	12561	10899	12252	11580	

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF NELL LOG INTERPRETATIONS

NELL NAME REF. EL.	M06 19	M07 19	M08 19	M09 13	M10 19	M10-ST1 19	M11 19	M12 19
SYMBOL								
TL	124	211	121	118	110	9904	121	124
cc								160
WI	220		215	210	200		190	220
2c	450	370	350	345	430		370	455
A	525	510	530	510	515		450	585
S	790	780	780	740	770		710	770
I	960	965	950	990	1030		860	920
P	1300	1190	1290	1230	1200		1010F400	1280
KA	1660	1390	1710	1560	1535		1180	1730
NE	2155	1760	2100	1885	1890		1650	2120
TP	2710	2510						2770
		2780TS	2830TS		2390MN		1808TS	
		2810BS	3390BS		2495MN		3800BS	
					4260MN		4153TS	
					4350MN		5345BS	
					4760MN		5920TS	
					4810MN		7365BS	
					5610MN		7390TS	
					575GMN		7580BS	
					5955MN		7650TS	
					6870MN		8130BS	
					6945MN	10260MN	8675TS	
					7095MN	10505MN	9730BS	
					7190MN	11090MN		
					8415MN	11200MN		
MP	3080							3520
M10	5570	5535	5320					5635
L	6860							
2L	8250							8550
2	9300		8190		9710			9400
W	10080	10490					10070	10090
BH	11040	11270					10420	11070
CI	11350	11550				11290	10670	11310
					10215MN		10731TS	
							11000BS	
B5	11615						11090	
CO	11965						11270	
TD	12552	11623	11985	2402	10452	12503	11743	12103

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. E.L.	M13 19	M14 15	M15 18	M16 19	M17 13	M18 13	M19 39	M20 23
SYMBOL								
TL	120	206	120	122	130	130	132	121
CS			160					150
CC			180					170
WI			260					230
2C	340		350		300		240	470
							600F120	
A	380		525		390	220		560
S	660	535	870		600	500		840
I	840	840	1000		685	625	640	1130
P	1255	1090	1280		950	830	950	1330
		1470TS		1750TS	1250TS	1270TS	1500TS	
KA	1680		1580					1720
	2390TS							
	4380BS	4680BS						
	5660TS	5680TS						
	6100BS	5950BS						
	4380BS							
	5660TS							
	6100BS							
	6530TS			10180BS				
	7890BS			10690TS				
NE			2270					2100
TP			2700					2430
MP			3500					2950
M10			5720					5690
L		6050	6810					7120
2L	8160		8605					8780
2	9260	8575	9420					9475
W	10020	9840	10140					101%
BH	10470	10240	10815					11260
	11610MN			11080BS				
	11870MN			11430TS				
CI		10645						11530
CO		11500						
TD	12208	12096	11150	11951	3033	2521	2576	13142

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	M21	M22	M23	M24	M25	M26	M27	M01
REF. EL.	26	22	31	23	20	37	23	23
=====								
SYMBOL								
TL	120	122	3092	3982	2534	300"	3002	126
cs	170							
CC	190							
WI	260	190						215
2C	420	310						340
A	545	400						537
S	945	800						800
I	1050	555						1040
P	1350	1330						1223
KA	1720	1850						1740
NE	2100	2230						2170
		27hOTS						
		3660BS						
TP	2730							2800
MP	3175							3750
M10			5820		5900	5630	5775	4350
L	7040	6520	7060	6970	7130	7980	7060	7115
		7790F300		7310F250				
2L	8790		8780	8500	8800	8730	8740	8510
2	5515	3545	9480	9200	9485	9455	9400	9415
w	10240	10110	10155	9650	10175	10230	10090	10290
BH	10710	10540	10900	10550	11020	10750	10610	10700
		11820MN						
CI	10520			11000	11230	11015		10990
B5								11330
C0	11725					11450		11745
AB	13035					12360		13155
								14040Pr
CII						12900		
MA						13450		
TD	13209	12423	11617	11764	12447	13755	10665	14205

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

NELL NAME	U01	U02	U03	U04	U05	U06	U07	U08
REF. EL.	13	19	13	19	19	17	15	33
=====								
SYMBOL								
TL	127	120	108	122	120	121	122	149
CS			150		140			
cc			170	160	200	150		
WI	220	230	220	250	250	240	240	260
2c	370	360	450	460	380	375	460	410
A	550	555	550	550	565	570	595	570
S	940	920	880	665	840	850	880	880
I	1050	1095	1155	1080	1170	1105	1150	1180
P	1370	1410	1380	1350	1420	1430	1410	1400
KA	1835	1855	1850	1820	1850	1880	1820	1870
NE	2210	2150	2140	2180	2140	2165	2125	2155
TP	2880	2875	2900	2870	2933	2965	2920	2960
MP	3250	3265	3260	3200	3470	3295	3990	4040
MIO	5860	5900	5310	5825	5930	5945	5910	5950
L	7050	7375	7435	8075	7440	7410	7360	8210
				8400F200				
2L	8910	8950	8570	8870	8960	3020	8930	8970
2	9620	9675	5675	9560	9675	9765	9640	3700
W	10355	10415	10420	10300	10440	10535	10400	10460
BH	10850	10925	10550	10800	10950	11070	10910	10980
CI	11115	11205	11240		11230	11375	11180	11295
								11340Pr
B5	11390	11500	11530		11525	11650	11470	11565
CO	11800	11525	11550	12060	12010	12210		12025
AB	12105	12290	12355	12950	12340			12400
R43	12260	12515				12860		12630
QP	12870	13150				12610		
CII	13110	13440	13550			13950		13615
MA	13465							14565
SD								15270
TD	14026	14301	14395	13058	13576	14351	13856	15355

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	U09	U10	U11	U12	AG01	AG02	AG03	AW01
REF. EL.	19	23	27	26	19	27	19	19
=====								
SYMBOL								
TL	113	2540	2513	2956	138	121	120	117
cc	130							
WI	240				245	260	230	235
2C	465				430	380	370	370
A	595				575	575	560	570
S	330				335	330	320	820
I	1165				1120	1165	1100	1115
P	1410				1440	1435	1425	1390
KA	1355				1910	1920	1950	1910
NE	2270				2320	2320	2270	2310
TP	2900				2320	2330	2950	2835
MP	4020				4550	4510	4390	4085
MIO	5950	5330	5920	5880	6200	6055	6000	5940
L	7430	7430	7475	7395	6945	7560	3430	7055
2L	3970	3940	3970	3930	9060	9090	100	9110
2	9660	9640	9690	9650	9305	9355	9320	9875
W	10425	10375	10440	10330	10600	10660	10600	10680
BH	10945	10370	10950	10370	11150	11230	11150	11255
CI	11230		11240	11030	11470	11550	11465	11595
B5	11670		11530			11390	11300	11925
CO	12040	13300	11960	12220		12530	12390	
AB	12330		12320			12950	12765	13015
R43	12620		12540			13235	13030	13290
OP	13290		13150					14165
CII	13620		13550			14390	14160	14705
						14620Pr		
CA								15210
MA							15030	
SD							15700	
TD	14033	14400	14004	14235	15501	15294	15916	15343

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	AW02	AW03	BA01	BA02	BA03	BA04	BA05	BA06
REF. EL.	23	18	13	13	13	13	13	13
SYMBOL								
TL	2994	121	118	119	120	124	119	109
cc								140
WI		240	225	215	215	240	210	225
2c		365	320	320	325	330	335	350
A		570	550	560	540	555	540	530
S		945	990	815	320	990	770	850
I		1130	1030	1005	1005	1030	1000	1015
P		1395	1145	1140	1165	1160	1140	1150
KA		1820	1760	1710	1740	1735	1780	1720
NE		2300	2230	2230	2225	2220	2240	2210
TP		2840	2340	2345	2795	2780	2785	2800
MP		4610	3850		3760		3735	3680
MIO		5925	4395	4320	4290	4250	4260	4200
L		7615	5470		4770	4760	4735	4665
			6225F300					
2L	9175	9200	7330	6790	6680	6645	6615	6585
							7650MN	
2	9925	9910	8340	8090	8065	3070		7970
W	10720	10710	3845	8540	8500	8550	8400	8450
						8760MN		
BH	11285	11265	9350	3940	8850	9030	8720	8930
CI	11530	11635	9540	9250	9040	9120	8840	9125
B5		11960			9750	9460	9160	9290
co	12650	12670	9710			9605		9490
AB	13050	13020	10470					
			10830Pr					
R43	13340	13295						
OP	14190							
CII	14480	14450						
CA	15220							
MA	15550							
TD	15329	15329	10934	9450	10002	9943	9251	9623

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF NELL LOG INTERPRETATIONS

NELL NAME REF. EL.	RA07 13	BA05 13	BA09 13	BA10 13	BA11 13	BA13 25	BA14 25	BA15 25
SYMBOL								
TL	120	119	140	120	125	120	120	117
CC		150						
WI	225	220	220	230	230	220	220	21:
2c	360	360	330	365	370	320	350	350
A	545	550	580	560	573	540	545	535
			890F70					
S	840	900		860	800	815	860	880
I	1015	960	1020	955	955	1025	1010	1000
P	1160	1170	1130	1215	1200	1160	1140	1140
KA	1750	1735	1740	1830	1370	1790	1730	1730
NE	2185	2180	2280	2270	2280	2260	2220	2190
TP	2815	2820	2880	2820	2910	2890	2860	2820
MP	3720	3750	3870	3790	3780			3700
MIO	4235	4250	5010	4370	4340	4420	4260	4125
L	5030	5140		5335	4890		4730	5325
2L	6490	6385	6715	6160	6330	7020	6435	6430
							7690F100	
2	7855	7840	8140	7790	7820	8110	7990	7855
W	8310	8270	8570	8270	8200	8610	8440	8310
								8550F300
BH	8770	8715	8920	8800	8610	9120	8765	
CI	8820	8805	9210	9055	8690	3310	8900	8670
						9515F200		
B5	8940	9000			8935			
CO	9070	9300				9555		
AB						10160		
TD	9352	9497	7482	9205	4048	10248	9251	8998

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

NELL NAME	BA16	BA17	BA18	BA19	BA20	BA21	BA22	BA23
REF. EL.	25	25	18	25	22	26	26	26
=====								
SYMBOL								
TL	119	2535	2524	2987	3022	2492	2536	3012
cc	155							
WI	240							
2c	355							
A	545							
S	830							
I	925							
P	1140							
KA	1735							
NE	2170							
TP	2750	2930	2790			2895	2960	
MP			3750			3960		
MI0	4205	4550	4250	4380	4385	5110	5190	5195
L	5200	5140			4900			
2L	6450	7650	6630	6940	6905	6900	7200	7210
2	7840	8540	7960	8140	8250	8230	8450	8290
		9150F200						
W	8300		8440	8680	8725	8655	8910	8865
BH	8540	'9340		9010	9030	9090	9390	9375
CI	3720	9530		9100	9130	9130	9455	9445
B5		9970		'9270	9300	9280	9620	9625
								9708F250
co		10190		9305	9400	9445	9840	9712
AB		10740					10260	10160
R43		11105					10490	10305
		11700Pr					10540Pr	10380Pr
TD	8986	14780	8837	9487	9876	9676	10618	10502

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	BA24	BA24-ST1	BBO1	BBO2	BJ01	BJ02	BR01	BR02
REF. EL.	26	26	19	23	19	19	355	255

SYMBOL								
TL	3024	9000	1014	1026	121	121		
WI					220	230		
2C					360	360		
A					540	550		
S					855	900		
I					1070	1090		
P			1230		1210	1240		
KA			1620	1585	1780	1820		
NE			2035	1930	2320	2430		
TP			2610	2585	2690	2730		
MP	3905				3540	3110		
MIO	4490		4000	3805	5370	5420		
				4347TS				
L	5555				6780	6945		
2L	6985				8290	8540		
					9520MN			
					10150MN			
2	8060					9255		
W	8535					10020		
						10160MN		
						10360MN		
BH	9070	9205			10920	10720		
CI	9325	9525						
B5	9470	9730						
CO	9600	9870						
AB		10360						
R43		10560						
TD	10023	10936	6002	4484	11215	11395	1268	1510

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	CF01	CG01	CG02	CK01	CK02	CK03	CK04	CK05
REF. EL.	19.45	19	19	22	17	13	21	23
=====								
SYMBOL								
TL	2540	121	2526	121	118	121	3004	3450
CS						165		
CC						195		
WI		230		240	240	230		
2c		370		340	330	350		
A		580		570	590	580		
S		920		770	890	880		
I		1130		970	1075	1045		
P		1310		1215	1245	1180		
KA		1885		1900	1805	1880		
NE		2170		2365	2365	2400		
TP		2905	2920	2783	2755	2690		
MP				4195	4300	4110		
MI0	5595	5850	5880	5450	5385	5320		5090
					6970F100			
L	8200	8280	7410	7010	7030	6860	7080	7030
2L	3985	9050	9090	8610	8500	8300	8430	8005
2	9660	9810	9815	9290	9150	8910	9090	
W	10375	10560	10570	9980	9800	9500	9680	
BH		11100	11120	10825	10530	10080	10310	
CI	11215	11400	11420		11000	10550		
B5		11715						
co	12000	12330	12910					
AB	13505	13660						
		13970Pr						
TD	13769	14458	14436	11736	11448	10766	10788	8503

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	CK06	CK09	CU01	CW01	cwo2	DR01	DR02	ET01
REF. EL.	32	40.5	33	19	19	19	36	21
=====								
SYMBOL								
TL	2019	3240	120	120	121	3014	4498	120
CS				180	180			
CC				200	200			
WI			260	240	250			240
2c			360	380	380			380
A			600	590	610			580
S			1050	920	1050			930
I			1170	1150	1170			1130
P			1310	1250	1240			1390
KA			1890	1880	1915			1980
NE			2310	2480	2270			2200
TP			2870	2850	2870			2860
MP			4310	4350	4370			4290
MIO	5370	5180				5890	5830	5965
L	7090	6760	8310	7570	7580	8370	8290	7470
2L	8300	8130	9120	9120	9140	9175	8970	9180
2	8710	8790	9810	9800	9820	9840	9740	9920
	9275F200							
W	9430	9380	10570	10560	10585	10690	10610	10720
BH	9980	9970		11140	11185	11320	11220	11290
CI		10230	11420	11400	11430	11640	11590	11640
B5				11760	11770	12030	12000	11990
CO			12270	12180	12250	12790	12740	12490
AB			13950	13985	13750	13270	13330	13000
R43					14130	13670	13805	13260
OP						13930	14040	14130
CII						15220	15400	14660
CA					14350	15690	15980	15140
MA						16140	16360	
SD						16820	17100	
							18370Pr	
LB							18630	
TD	10333	10875	14546	14445	14433	17669	19444	15345

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	ET02 19	ET03 19	ET04 19	ET05 19	ET06 22	ET07 18	ET08 21	ET09 19
SYMBOL								
TL	120	120	122	119	3019	3018	2502	2538
cs	180							
cc	200							
WI	230	230	240	220				
2c	360	360	380					
A	575	580	600	590				
S	920	910	940	995				
I	1140	1150	1160	1155				
P	1235	1290	1280	1310				
KA	1850	1940	1960	1860				
NE	2230	2305	2410	2410				
TP	2920	2940	2870	2980			2850	2850
MP	4395	4335	4380	4405		4305		
MIO	5900	5880	5920	5750		5950		5950
L	7430	7480	7730	7725	7710	7655	7610	7635
2L	9100	9210	1255	9240	9240	9210	9140	9175
2	9820	9915	9955	9940	9960	9945	9880	9925
W	10580	10700	10760	10775	10745	10720	10670	10720
BH	11140	11275	11325	11315	11330	11300	11220	11300
CI	11430	11610	11650	11640	11660	11600	11550	11645
B5	11930	11960	12050	12005	12040		11880	11980
	12110F300				12420F150			
CO	12230	12450	12530	12530	12540		12550	12670
AB	12710	12930	13020	13020	13050		12870	13050
R43	12970	13200	13295	13300	13320		13120	13275
OP	13745	14050	14165		14200			
CII	14200	14575	14670	14515	14740		14265	14425
CA		15020	15110		15210			
MA					15530			
SD							15850	16090
TD	14472	15177	15267	15340	15915	15940	16381	16700

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	ET10 21	ET11 19	ET12 19	GC02 18	GM01 19	GP01 19	GP02 19	GPO?-ST1 19
=====								
SYMBOL								
TL	3022	120	122	1848	3010	90	120	9513
CS		160						
CC		130	160					
WI		270	240			210	205	
2C		370	370			345	335	
A		590	575			545	530	
S		965	940			830	730	
I		1115	1120			1110	1010	
P		1330	1330			1290	1248	
KA		1900	1900			1755	1690	
NE		2270	2260	2160		2125	1980	
TP		2910	2900	2745		3000	2670	
							5120TS	
							6260BS	
MP	4370	4380	4365		3740	3960		
MIO	5920	5890	5980	4245	5695	5650		
				7850F250	8770F300			
L	7740	7570	8415			6670		
2L	9270	9090	9050	8140	9120	8860		
2	9970	9820	9780	8830	9805	9670	8620	
				9300F100				
W	10780	10590	10545	4525	10570	9845	9505	
BH	11350	1113s	11080	9970		10520	9875	9900
CI	11680	11465	11380	10350	11440	10755	10210	10315
							10750F60	
B5		11770	11700			11005		
C0	12570	12360	12270		11580	11975		
AB	13065	12720	12605			12440		
R43	13340	12955	12845					
CII	14600	14080	13850		13900			
					14480Pr			
TD	15816	14478	14402	10750	14622	13755	11074	11600

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	GP03 15	GP04 19	GP04-ST1 19	GP05 19	GP05-ST1 19	GP06 21	GP07 21
=====							
SYMBOL							
TL	140	133	9350	120	8472	120	3540
CS						170	
CC						190	
WI	210	210		190		225	
2C	335	340		340		350	
A	535	530		510		550	
S	815	905				850	
I	1050	1020		1020		1110	
P	1240	1265		1135		1300	
KA	1705	1700		1575		1785	
	1820F100						
NE	1860	1970		1770		217s	
				2620TS			
				2900BS			
				4030TS			
				428583			
TP	2695	2700				2645	
MP	3830	3750				3450	413s
		5850TS		4400TS			
		6030BS		4640BS			
		6450MN		4880TS			
M10	5450					5620	5650
	6480MN			7828BS			
L						6920	6500
2L						8045	8930
2						8920	9770
W	9610	10410		9710	9480	9925	9940
BH	11120	11020		10165	9970	10665	10360
CI	11580	11360		10550	10330	10910	10680
B5		11680		1122s		11205	11390
co		12305				12040	12145
AB		13220				12490	12615
R43							12850
OP							13525
CII							13930
TD	11998	13364	11150	11557	10744	13576	14095

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	GP08 2s	GP08-ST1 25	GR01 13	GR03 13	GR05 13	GR05-ST1 13	GR06 13	GR07 13
SYMBOL								
TL	144	3522	108	114	100	6690	1584	1717
WI	210		205	220	225			
2C	350		340	340	340			
A	525		540	575	580			
			560F80					
S	850		750	770	890			
I	1000		870	1020	990			
P	1275		1070	1110	1145			
KA	171s		1650	1680	173s		172s	
NE	2045		2120	2155	2250		2220	2220
TP	2715		2760	2825	2920		2735	2940
MP	3145	3890		3660				
MIO	5440	5420	4095	4190	5150		4195	5090
L	6840	7145	444s	4620			4660	
							6510F150	
2L	8660	8680		6360	7085	8030		6960
2	9545	9500		7743	8310	8130	7845	8190
W	10505	10370		8230	8725	8460	8300	8515
BH	11000	10990					8660	
CI	1143s	11360					8830	
B5	1173s	11770						
co	12265							
AB	12650							
TD	13528	12027	5487	8350	9159	8551	8900	8591

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	GR08 13	GR08-ST1 13	GR09 13	GR09-ST1 13	GR10 13	GR11 13	GR12 13	GR12-ST1 13
=====								
SYMBOL								
TL	7711	7732	1834	6949	143	148	1815	
CC					165			
WI					240	252		
2c					360	365		
A					565	565		
S					800	910		
I					1030	1055		
P					1160	1200		
KA					1730	1820		
NE			2160		2175	2210	2255	
TP			2800		2825	2770	2870	
MP			3605		3690	3770		
MIO			4130		4180	4330	4500	
			5100		5020	5245	5110	
2L			6335		6325	6095	6175	
2			7665	7700	7705	7700	7665	
W	7995	8030	5125	8215	8200	8175	8080	8155
BH		8470		8580	8700	8510	8415	8650
CI					8825	8690		
TD	8257	8489	8304	9018	8850	9058	8528	9065

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIANATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

NELL NAME REF. EL.	GR13 13	GR14 13	GR15 13	GR15-ST1 13	GR16 13	GR16-ST1 13	GR17 13	GR18 13
SYMBOL								
TL	1824	138	1832	6840	131	4120 4785MN	146	130
WI		220			190		210	190
2C		335			320		325	315
A		520			520		565	510
					800F130			
S		790			820		720	750
I		980			860		870	895
P		1100			1020		1080	1020
KA		1690			1555		1663	1570
NE	2300	2120	2290		2045		2285	1970
TP	2900	2745	2830		2540		2720	2640
								3089TS
MP		3580	3700		3490		3700	
					4040MN			
MIO	4520	4065	4400		4070		4060	
					4820MN			
					5170TS			
L	6100	4905	4975				4985	
2L	6360	6250	7780	7780		6021	6270	
	8000F1000							
2		7570	8540	8610		7180	7560	
W		8045	8975	8920		7600	8000	
						7700F500		
						7894TS		
BH			9150					
CI			9240					
TD	8946	8300	9506	9162	5185	7962	8054	3498

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	GR19	GR19-ST1	GR20	GR21	GR23	GR24	GR25	GR25-ST1
REF. EL.	13	13	13	24	22	20	27	27
=====								
SYMBOL								
TL	94	6100	176	1785	2273	1831	2951	7000
WI	205		240					
2c	350		320					
A	520		590					
S	870		1025					
I	930		1065					
P	1155		1250					
KA	1790		1760					
NE	2210		2260	2210		2210		
T P	2790		2895	2830	2785	2890		
MP	3435		3880	3680	3910	3457	4075	
M10	4350		4370	4220	4370	5020	4200	
	5670TS					5630MN		
						5930MN		
L			5920	5180	5440		5530	
2L			8280	6475	6310	6570	6550	
				7520MN		7080MN		
2		7610	8960	7830	7730	7915	7940	7940
		7910F300						
W		7960	3690	3330	8180	8235	8400	8335
				8550MN		8402TS		
BH		8550	10250	8660	8490		8800	8720
CI			10600		8740		8940	8860
B5			10790					
co			11080					
AB			11475					
TD	5704	8745	11586	9192	8808	8436	9099	9004

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	GR26	GS01	GW01	GW02	HB01	HB02	HB03	HE04
REF. EL.	27	32	18	22	13	19	13	13
=====								
SYMBOL								
TL	2494	1110	118	3002	101	103	110	138
CS							200	
CC					150	170	230	270
WI			230		205	205	275	310
2c			375		360	370	350	365
A			620		570	575	570	555
S			970		820	810	840	840
I			1160		1020	990	1095	1130
P			1405		1260	1280	1325	1350
KA			1840		1690	1695	1710	1705
NE			2315		2045	2055	2100	2080
TP	3050		2830		2755	2760	2800	2810
			3170F100					
MP	4000		3700		3250	3715	333s	3360
MIO	4570	4060	5970	5960	4250	4290	4340	4380
		5990TS						
		6040BS						
		7020TS						
L	5480		7570	7540	7065	7430	7310	7375
2L	6425		9150	9150	8400	8600	8805	8920
	8100F1000							
2			9900	9910	9225	9480	3730	9820
W	8415		10740	10750	10035	10320	10660	10870
BH	8900		11300	11335		10770	11200	11460
CI	9130		11650	11680		11170	11500	11810
						12200F500		
B5	9280		12040	12080				
CO	9390		12740	12825				12710
AB			13165	13280		12340		13500
R43			13550	13680				
			14360Pr					
OP				14510				
CII			14810	15150				
CA				15680				
MA				16050				
				16070Pr				
SD			16480	16630				
TD	9676	7112	17183	17009	10275	12543	12368	13604

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	HB05 13	HB06 13	HB07 13	HB08 13	HB09 19	HB10 19	HB11 19	HB12 19
SYMBOL								
TL	139	168	113	119	102	110	1984	2588
cc			140		140	160		
WI	190		235	265	210	225		
2c	330	380	375	380	320	320		
		540F80						
A	550	550	550	545	570	588		
S	800	805	820	805	740	1030		
			950F150					
I	975	1000		980	1060			
P	1230	1225	1100	1240	1250			
KA	1660	1650	1635	1670	1730			
NE	1950	1950	2000	1950	2030	2080	2100	
TP	2635	2610	2630	2620	2690	2770	2785	2790
MP	3140	3130	3450	3440	3610			3770
MIO	4005	3980	4050	3980	4180	4310	4330	4340
	5820F500	5570TS	7475TS					
	7535TS							
	7610BS							
	7670TS							
L					6760			
2L						8635	8790	8810
							9590F50	
2					8770	9540		9735
W					9690	10380	10555	10630
BH						10835	11010	11020
CI						11220	11965	11340
B5							12085	11680
CO							12840	12330
TD	7723	5692	7495	5638	10183	11853	13501	12622

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	HB13	HB13-ST1	HB13-ST2	HB14	HB15	HE16	HB16-ST1	HG01
REF. EL.	19	19	19	23	27	31.3	31.3	19
SYMBOL								
TL	132	10290	10364	1850	2978	1506	3650	106
CC	170							150
WI	240							220
2C	380							380
A	585							585
S	860							855
I	1060							1075
P	1300							1300
KA	1700					1650		1700
-NE	2077			2040		1940		2100
TP	2720			2750		2600		2800
MP	3730							4015
MI0	4320			4240	4220	3960	3950	4320
						4770F170	5320F170	
						5305TS	5655TS	
L	7480				7015			7845
2L	3670			8400	8360			8765
2	9560			9230	9180			9700
W	10420	10420	10420	10080	10075			10615
BH	10870	10870	10885	10535				11080
CI	11320	11380	11410	10805				11310
85		11750	11750	11310				11360
CO		12330	12190					12390
TD	11511	13081	12250	11759	10440	5320	5686	13392

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF NELL LOG INTERPRETATIONS

NELL NAME	HG02	HG03	HG03-ST1	HG04	HG04-ST1	HG05	HG06	HG07
REF. EL.	19	20	20	21	21	21	21	26
SYMBOL								
TL	126	3433	8780	142	9180	3028	2531	2022
CC	180							
WI	210							
2c	380			400				
A	580			530				
S	s40			800				
I	1030			995				
P	1285			1255				
KA	1670			1705				
NE	1225			2020				
TP	2760			2665			2733	2730
HP	3825	3995		3400		3635		3305
MIO	4330	4305		5215		5270	4260	4275
L	7665	7750		7030		7650	7300	7410
				8130F1350				
2L	3625	8650				8505	8445	8505
2	9510	9550	9540			9320	3300	9370
W	10370	10420	10330	8640		10315	10087	10185
			10745F300					
BH	11025	10890		3855	9920	10955	10550	10610
				10350TS	10460TS			
					111208S			
CI	11390	11460	10980			11425	10740	11000
	11750F1300							
B5		11810				11880	11355	11630
co		12405				12250	11770	11320
		12900Pr						
R43	12530							
	12725Pr							
TD	12880	13033	11403	10407	11420	13300	11592	11975

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	HG08	HH01	HH02	HR01	HR02	HW01	HW02
REF. EL.	22	19	19	19	19	13	19
R	22	17	19	19	19	13	19.3
<hr/>							
SYMBOL							
TL	2566	263	2988	3535	2362	3507	110
WI		230					130
2C		380					360
A		625					525
S		930					845
I		1180					980
P		1410					1200
KA		1880					1620
NE		2280					1920
TP	2750	2730			2740		2590
MP	3255	4300					3320
MI0	4235	5940	5850	5880	5815	4379	3865
							5060TS
							5360BS
							5680TS
							6090BS
L	7150	8670	8590	8315	8520	7310	
2L	8315	9010	9340	9000	8840	8830	
2	9150	10020	4730	9880	9675	9745	
W	9960	10575	10400	10570	10370	10700	
		11050F200					
BH		11150	11170	11170	11112	11305	
CI		11460	11400	11470	11480	11640	
B5		11900	11645	11900	11900		
CO		12600	12620	12685	12640	12570	
AB		13055	13155	13150	13170	13875	
						13910Pr	
R43		13490	13640	13750	13730		
OP		14320	14480	14460	14480		
		14540F40					
CII		14950	15080	15170	15180		
CA		15370	15510	15410	15650		
HA		15800	15960	16080	16115		
SD		14425	14620	16760	16825		
TD	10322	17334	16891	17444	17644	14012	6100

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF NELL LOG INTERPRETATIONS

NELL NAME REF. EL.	HW03 19	HW03-ST1 19	HW04 13	HW05 21	HW05-ST1 21	HW06 17	JA01 19	JA02 19
SYMBOL								
TL	1847	9230	104s	1837	11300	1843	120	3016
WI							235	
2C							385	
A							400	
S							980	
I							1180	
P							1360	
KA				2045			1880	
NE				2355		2000	2295	
TP				2740		2430	2910	
MP				3680				
MI0	4245		3950	4250		4085	6010	5910
						7798TS		
L				6870			8640	8010
2L	8450			8180			9430	9420
2	7240	9240		9290			10290	10280
W	10140	10295		10310			11270	11300
		10660F450						
BH		11005		11310	11310		11940	12020
CI				11540	11540		12350	12430
B5							12740	12925
co				12270	12270		13470	13405
AB				13415	13415		13875	14070
				13SOOPr	13S00Pr			
R43							14410	14470
JD	10603	11210	5848	14334	13881	7843	15084	15307

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.) ; ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	JA03 25	J801 19	J802 19	JD01 19	JD02 19	JE01 20	JS01 19	MS01 13
=====								
SYMBOL								
TL	3025	120	2525	124	120	2515	120	1044
WI		230		205	205		235	
2C		450		350	320		350	
A		430		580	590		560	
S		915		875	985		915	
I		1195		1055	1058		1050	
P		1390		1300	1330		1290	1240
							1410F100	
KA		1885		1775	1700		1800	1610
NE		2290		2140	2120	2515	2315	1920
T?		2805	2815	2800	2850	2940	2770	2430
HP		4385	4040	4000	4050	3585	3580	
MIO	5940	5980	6100	4340	4400		5410	4000
								7290TS
L	7910	8440	8165		7588	8025	6945	
			8610F200					
2L	9400	9030	9060	8730	8950	9185	8510	
2	10280	9430	9810	8730	9930	10200	9175	
				9985F50				
W	11245	10570	10430	10565	10922	11225	9840	
BH	11950	11225	11200	11120	11530	11870	10360	
CI	12320	11480	11510	11403	11910	12330	10540	
				11550F500				
B5	12820	11840	11850		12300	12785		
co	13430	12530	12520	11955	12900	13500		
				12290F250				
AB	13790	12340	12920	13240	14450	14135		
					14585Pr			
R43	14220	13310	13215			14575		
		13420F100						
OP	14940	14140	13800					
CII	15570	14720	14420			15905		
						16960F700		
MA			15420					
			15900F100					
SD			14040			17110		
						17250Pr		
TD	15814	15344	14831	13840	14115	17722	10700	7300

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	MS02	MS03	MS03-ST1	MS04	MS04	SB01	SC01	SC02
REF. EL.	13	13	13	13	2s	19	19	19
=====								
SYMBOL								
TL	1037	1003	4220	1039	1031	120	120	120
CS						155	180	
CC						190	200	
WI						220	240	240
2c						370	370	375
A						485	580	400
S						900	900	860
I						1140	1110	1120
P	1230	1245		1220	1255	1370	1430	1300
KA	1600	1570		1405	1640	1825	1870	1890
NE	1945	1310		1940	1980	2170	2150	2170
TP	2625	2620		2445	2655	3020	2900	2960
HP						4150	3740	
M10	3970	3875		3025	4025	4450	5905	5920
		5320TS		5350TS	5501TS			
						7450	7480	7500
2L						8475	9000	9010
2						9310	9720	9720
W						10545	10470	10470
BH						11260	11000	11000
CI						11410	11280	11260
B5						12190	11585	11550
co						12465	12070	
AB						13330		
R43						13740		
CII						14750	13830	13785
TD	5929	5852	5839	5585	5519	154ss	14144	14150

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.) ; ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME REF. EL.	SG01 19	SG02 2s	SG03 15	SG04 15	SG05 40	SH01 19	SH02 19	SH03 19
SYMBOL								
TL	120	122	2534	2593	3020	124	122	120
WI	240	245				230	220	210
2C	370	380				440	435	430
A	620	580				630	430	620
S	905	500				895	500	955
I	1150	1150				1160	1150	1150
P	1240	1280				1405	1410	1360
KA	1880	1940				1910	1880	1895
NE	2390	2420				2285	2390	2265
TP	3000	3070				2810	2800	2780
MP	4340	3710				4330	4220	4200
							4540F170	
M10	5840	5830	5850	5910	5930	6000	5950	5950
							8340F400	7400F200
L		7430	7415	7420	7835	8270		8175
2L	9100	9090	9105	9120	9145	9080	9050	9030
2	9810	5800	3810	9835	9850	9820	9780	9780
W	10540	10540	10570	10605	10620	10450	10670	10635
BH	11100	11105	11105	11185	11200	11225	11220	11220
CI	11350	11310	11400		11465	11540	11595	11383
B5	11720	11705	11760		11810	11900	11940	11955
co	12170	12140	12185	12585	12410	12590	12700	12730
				14100Pr				
AB	13130	13945	13980		12760	13030	13180	13225
R43	13550				13015	13365	13600	13610
					13800Pr			
OP						14215	14420	14500
CI	14100				14100	14750	15060	15180
CA	14400					15300	15590	15640
MA						15640	15760	16080
SD					15545	16225	16610	16760
LB							17810	
TD	14433	1441s	14407	15217	15756	14640	18469	16954

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF NELL LOG INTERPRETATIONS

WELL NAME	SH04	SK01	SM01	SM02	SM03	SP01	SP02	SP03
REF. EL.	17	19	17	15	15	15	15	25
=====								
SYMBOL								
TL	3040	120	120	120	2524	121	121	3017
cs			170					
cc			200					
WI		220	235	230		220	230	
2c		350	340	345		340	410	
A		630	550	575		625	640	
S		850	890	880		845	895	
I		1215	1140	1120		1160	1130	
P		1395	1250	1260		1490	1420	
KA		1880	1510	1920		1880	1890	
NE		2240	2260	2265		2250	2250	
TP		2510	2815	2820	2830	2740	2750	
MP	4270	4280	4280	3450		4350	4335	3580
MI0	4000	5730	5400	5570		5850	5845	5840
		8265F400					6290F300	
L	8275		8230	8320	8230	8450	8460	7525
2L	9090	9240	5000	8545	5020	5330	9345	"340
2	5830	10110	9700	5640	5700	10155	10190	10185
		10825F900						
W	10665		10440	10345	10440	11045	11180	11140
BH	11250	10895	10595		11000	11730	11805	11845
CI	11575	11125	11210	11130	11940	11525	11980	12050
B5	11925	11445	11535			12420	12730	12600
co	12620	11970	11520	11790		13240	13440	13450
AB	13052	12535	13430	13500	13680	13710	14760	13780
R43	13440	13040				13510	15150	14140
							15250F300	
OP	14275	13450				14480	15340	14540
CII	14870	14320				15150	15875	14920
CA	15375	14450	141so					15480
HA	15700	15510						
SD	16240							
TD	17048	15541	14235	1355s	14127	15201	16077	15553

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEETBELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	ST01	SW01	WG01	WG02	WG03	WG04	WG05	WG06
REF. EL.	19	19	19	27	20	25	19	27
=====								
SYMBOL								
TL	120	115	123	3040	3005	2993	3009	3004
WI	230	210	240					
2c	375	340	360					
A	590	580	580					
S	835	500	515					
I	1125	1170	1140					
P	1250	1345	1310					
KA	1855	1810	1910					
NE	2250	2215	2200					
TP	2830	2880	2840					
MP	4240	3450	4640			4360	4250	
MIO	5600		6010	6000	6040	6010		r-050
				6150F200				
L	7520	8020	7085	8400	7440	7710	7740	8500
21	5005	5230	5260	9210	5240	5305	9240	9350
2	5475	10170	10010	9980	10010	10040	9940	10095
W	10405	11215	10810	10830	10820	10855	10740	10920
BH	10970	11850	11420	11430	11430	11470	11350	11505
CI	11150	12255	11760	11750	11825	11820	11640	11895
B5	11515	12730	12160	12200	12185	12210	12015	12305
co	11505	13400	12730	12640	12740	12750	12590	12500
AB	12580		13290	13450	13350	13350	12890	13480
R43		14020	13620	13755	13665	13710	13105	13785
		15250F1750						
OP			14520	14750	14580	14600		
CII			14860	15430	15015	15220	13890	15250
CA	14030		15440	15580	15730	15745		
			15700Pr			15770Pr		
MA			16010	16340	16095	16080		16250
SD		15400	14615	17100	14435	16700	14845	16860
PP			17510				14940	
LB				18405				
				19120Pr				
TD	1414s	15841	17784	20430	14587	17247	15742	17581

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT.); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF WELL LOG INTERPRETATIONS

WELL NAME	XB02	XB03
REF. EL.	24	23
=====		
SYMBOL		
TL	4133	4505
L	6960	
2L	S525	9040
2	9615	10100
W	10860	11115
8H	11410	11750
CI	11650	12070
B5	12590	12530
co	12980	13120
AB	13770	13505
R43	14150	14520
		14930Pr
CII	15180	
MA	16590	
SD	17150	
TD	17311	14994

TABLE C.4

SUMMARY OF SHALLOW BORINGS OVER
WEEKS ISLAND SALT DOME

Table C.4 is primarily a tabulation of the salt exploration borings over the salt dome. Borings that are listed as NOT SHOWN, were not located by Morton. The table also includes borings made for testing and grouting purposes as well as the SPR fill and vent holes. For each boring signified by the MY lease symbol and a boring number, the following information is given:

- Original boring number or reference name.
- North and east coordinates based on the Louisiana Coordinate **System** (ft).
- Source or operator of the boring.
- Reference elevation in feet above Mean Sea Level.
- Depth to top-of-salt, if any, in feet below reference elevation.
- If information from the boring was used in this study.

SANDIA NATIONAL LABORATORIES

REEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF SALT EXPLORATION BORING
OVER WEEKS ISLAND SALT DOME

BORING NUMBER	ORIGINAL BORING NO.	COORDINATES		SOURCE	REFERENCE	TOTAL	DEPTH	USED FOR
		EAST	NORTH		ELEVATION	DEPTH	TO SALT	STUDY
=====								
MY01	1	1852685	414235. 8	BILLINGSLEY	50	245		Y
MY02	2	1853402	414090. 7	BILLINGSLEY	30	175		Y
MY03	3	1849101	418733. 0	BILLINGSLEY	50	218		Y
MY04	4	1847065	418554. 6	BILLINGSLEY	65	275	275	Y
MY05	5	1847579	418712. 9	BILLINGSLEY	55	150		Y
MY06	6	1846990	419128. 4	BILLINGSLEY	65	385		Y
MY07	7	1846585	418041. 5	BILLINGSLEY	65	110		Y
MY08	8	1847438	417810. 0	BILLINGSLEY	68	205	205	Y
MY09	9	1848700	416942. 5	BILLINGSLEY	91	147	147	Y
MY10	10	1849618	416491. 4	BILLINGSLEY	99	180	618	Y
MY11	11	1848731	416443. 6	BILLINGSLEY	95	180		Y
MY12	12	1848398	415280. 1	BILLINGSLEY	87	162	162	Y
MY13	13	1849784	414742. 7	BILLINGSLEY	122	195	195	Y
NOT SHOWN	14			BILLINGSLEY				N
NOT SHOWN	15			BILLINGSLEY		158		N
MY16	16	1849087	413833. 4	BILLINGSLEY	74	745	145	Y
MY17	17	1849816	413728. 7	BILLINGSLEY	71	145	145	Y
MY18	18	1848891	412991. 9	BILLINGSLEY	40	162	616	Y
MY19	19	1848481	412962. 4	BILLINGSLEY	25	228		Y
MY20	20	1848975	413364. 4	BILLINGSLEY	47	210	210	Y
MY21	21	1848800	413367. 3	BILLINGSLEY	48	165	165	Y
MY22	22	1848402	413580. 6	BILLINGSLEY	61	160	160	Y
NOT SHOWN	23			BILLINGSLEY		160		N
NOT SHOWN	24			BILLINGSLEY		150	150	N
MY25	25	1848089	413718. 4	BILLINGSLEY	43	110	110	Y
NOT SHOWN	26			BILLINGSLEY		169	169	N
NOT SHOWN	27			BILLINGSLEY		177	177	N
NOT SHOWN	28			BILLINGSLEY		216	216	N
NOT SHOWN	29			BILLINGSLEY		212	212	N
NOT SHOWN	30			BILLINGSLEY		88	88	N
NOT SHOWN	31			BILLINGSLEY		121	121	N
MY32	32	1846313	413229. 2	BILLINGSLEY	10	919		Y
MY33	33	1848186	414688. 2	BILLINGSLEY	49	123	123	Y
MY34	34	1848340	414637. 5	BILLINGSLEY	69	107	107	Y
MY35	35	1848592	414590. 7	BILLINGSLEY	81	141	141	Y
MY36	36	1848331	414158. 1	BILLINGSLEY	56	97	97	Y
MY37	37	1848573	413928. 6	BILLINGSLEY	45	101	101	Y
NOT SHOWN	38			BILLINGSLEY				N
NOT SHOWN	39			BILLINGSLEY				N
MY40	40	1848651	414284. 4	BILLINGSLEY	81	138	138	Y
MY41	41	1848861	414292. 3	BILLINGSLEY	80	145	145	Y

GEOLOGICAL CORRELATIONS MADE FROM DRILLERS' LOGS; SEE TABLE C.3A FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF SALT EXPLORATION BORINGS
OVER WEEKS ISLAND SALT DOME

BORING NUMBER	ORIGINAL BORING NO.	COORDINATES		SOURCE	REFERENCE ELEVATION	TOTAL DEPTH	DEPTH TO SALT	USED FOR STUDY
		EAST	NORTH					
MY83	83	1848551	418415.0	BILLINGSLEY	62	204	204	Y
MY84	84	1848363	419027.6	BILLINGSLEY	53	801	253	Y
MY85	TEST HOLE 1	1846240	415730.0	HORTON	7	328	317	Y
MY86	TEST HOLE 2	1846100	416260.0	HORTON	15	385	359	Y
MY87	TEST HOLE 3	1845710	416870.0	HORTON	25	806	801	Y
MY88	TEST HOLE 4	1846010	416900.0	HORTON	15	341	305	Y
MY90	H102	1848210	414358.1	ACRES	53	98	93.5	Y
MY91	H101	1848089	415220.3	ACRES	75	183	162.5	Y
MY92	24	1847523	415785.7	McCLELLAND	65	169	149	Y
MY93	21	1847537	415261.8	McCLELLAND	48	144	143	Y
NY94	FILL HOLES 1 and 2	1850102	413672.8	FENIX & SCISSON	76	197	197	Y
MY95	VENT HOLE	1849328	414526.7	FENIX & SCISSON	95	197	197	Y
MY96	GROUT #2	1847787	415140.0	FRONTIER KEHPER	50	172	150	Y
MY101	81	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	74	70		N
MY102	82	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	74	80		N
MY103	83	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	75	5		N
MY104	84	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	75	70		N
MY105	85	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	76	5		N
MY107	87	NEAR PRODUCTION	SHAFT	SOIL TEST ENG.	76	5		N
MY111	11	1847483	415843.0	McCLELLAND	70.3	163	157	N
MY112	12	1847573	415843.0	McCLELLAND	67.5	157	153	N
MY113	13	1847573	415753.0	McCLELLAND	61.1	147	143	N
MY114	14	1847483	415753.0	McCLELLAND	63.4	145.4	145.4	N
MY115	15	1847528	415663.0	McCLELLAND	57.2	60		N
MY116	16	1847528	415528.0	McCLELLAND	53.7	60		N
MY117	17	1847528	415393.0	McCLELLAND	50.9	60		N
MY118	18	1847463	415321.8	McCLELLAND	47.3	146.5	142.5	N
MY119	19	1847593	415321.8	McCLELLAND	55.8	148	148	N
MY120	20	1847593	415191.8	McCLELLAND	655	150.5	148	N
NY122	22	1847728	415226.0	McCLELLAND	59.2	60		N
MY123	23	1847922	415155.0	McCLELLAND	53.1	60		N
MY130	GROUT #1	1847805	415083.0	FRONTIER KEHPER	50	230	150	Y
MY131	GROUT #4	1847799	415111.0	FRONTIER KEHPER	50	195	151	Y
MY132	GROUT #5	1847766	415089.0	FRONTIER KEHPER	50	177	152	Y
MY133	GROUT #6	1847919	415128.0	FRONTIER KEHPER	52	180	155	Y
MY134	GROUT #7	1847802	415098.0	FRONTIER KEHPER	50	210	160	Y
MY135	GROUT #8	1847864	415084.0	FRONTIER KEHPER	52	165	145	Y
MY136	GROUT #10	1847806	415089.0	FRONTIER KEHPER	50	160	149	Y
MY137	GROUT #11	1847853	415103.0	FRONTIER KEHPER	52	155	145	Y

GEOLOGICAL CORRELATIONS MADE FROM DRILLERS' LOGS; SEE TABLE C.3A FOR LOG INTERPRETATIONS

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF SALT EXPLORATION BORINGS
OVER WEEKS ISLAND SALT DOME

BORING NUMBER	ORIGINAL BORING NO.	COORDINATES		REFERENCE ELEVATION	TOTAL DEPTH	DEPTH TO SALT	USED FOR STUDY
		EAST	NORTH	SOURCE			
MY42	42	1848292	413926.1	BILLINGSLEY	69	112	Y
MY43	43	1848331	415068.9	BILLINGSLEY	85	139	Y
MY44	44	1848636	414897.5	BILLINGSLEY	77	147	Y
NOT SHOWN	45			BILLINGSLEY			N
NY46	46	1848828	413895.6	BILLINGSLEY	66	145	Y
MY47	47	1847773	415033.6	BILLINGSLEY	58	160	Y
MY48	48	1847735	414393.7	BILLINGSLEY	36	145	Y
MY49	49	1849164	416224.2	BILLINGSLEY	99	176	Y
MY50	50	1850830	414966.9	BILLINGSLEY	52	134	Y
MY51	51	1847837	416044.6	BILLINGSLEY	47	131	Y
MY52	52	1847016	414552.9	BILLINGSLEY	25	275	Y
MY53	53	1846535	414535.9	BILLINGSLEY	24	435	Y
MY54	54	1849312	415646.8	BILLINGSLEY	138	199	Y
MY55	55	1850274	415884.3	BILLINGSLEY	132	190	Y
MY56	56	1849599	415641.0	BILLINGSLEY	130	185	Y
NY57	57	1850715	414332.8	BILLINGSLEY	102	159	Y
MY58	58	1850691	413648.0	BILLINGSLEY	89	208	Y
MY59	59	1850154	414008.2	BILLINGSLEY	94	182	Y
MY60	60	1850143	413601.0	BILLINGSLEY	73	194	Y
MY61	61	1850625	413250.3	BILLINGSLEY	66	253	Y
MY62	62	1846855	414883.6	BILLINGSLEY	27	255	Y
MY63	63	1847238	415196.3	BILLINGSLEY	55	137	Y
MY64	64	1847483	415512.6	BILLINGSLEY	59	143	Y
MY65	65	1847001	416679.0	BILLINGSLEY	28	187	Y
MY66	66	1848102	416703.4	BILLINGSLEY	86	160	Y
MY67	67	1848567	418692.2	BILLINGSLEY	50	217	Y
MY68	68	1851389	417448.9	BILLINGSLEY	49	270	Y
MY69	69	1855669	414978.1	BILLINGSLEY	10	976	Y
NY70	70	1851790	417454.8	BILLINGSLEY	36	327	Y
MY71	71	1852162	418773.2	BILLINGSLEY	30	414	Y
MY72	72	1851873	416763.3	BILLINGSLEY	30	262	Y
MY73	73	1853004	417450.1	BILLINGSLEY	34	280	Y
MY74	74	1854277	417192.2	BILLINGSLEY	10	650	Y
UT75	75	1849478	414110.5	BILLINGSLEY	82	169	Y
NY76	76	1849168	413502.6	BILLINGSLEY	49	211	Y
NY77	77	1847417	414763.3	BILLINGSLEY	47	160	Y
MY78	78	1847316	415895.8	BILLINGSLEY	72	160	Y
NY79	79	1848215	417638.1	BILLINGSLEY	70	205	Y
MY80	80	1851040	415700.2	BILLINGSLEY	41	235	Y
MY81	81	1851163	413873.0	BILLINGSLEY	101	192	Y
MY82	82	1849142	417218.5	BILLINGSLEY	73	163	Y

GEOLOGICAL CORRELATIONS MADE FROM DRILLERS' LOGS; SEE TABLE C.3A FOR LOG INTERPRETATIONS

TABLE C.5

SUMMARY OF DRILLERS' LOGS INTERPRETATION

Table C.5 summarizes geologic interpretations of borings listed in Table C.4, Summary of Shallow Borings. The depths to each stratigraphic unit are measured in feet below the well reference elevation (REF. EL). The stratigraphic symbols are discussed in Section 4.3 and summarized in Table 5.1. The following additional symbols are used:

- 275TS: At 275 ft below the reference elevation, salt was encountered (Top-of-Salt).

- 189GY: At 189 ft below the reference elevation, gypsum was encountered.

In addition, the words: wood, void, shells, rock, and shale are used to describe materials encountered during boring. At the bottom of each column, the total measured depth (TD) of each boring is listed in feet below reference elevation.

SANDIA NATIONAL LABORATORIES

WEEKS ISLAND GEOLOGICAL CHARACTERIZATION

SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

WELL NAME								
REF. EL.	MY01 50	MY02 30	MY03 50	MY04 65	MY05 55	MY06 65	MY07 65	MY08 68
=====								
SYMBOL								
CL	0		0	0			0	0
SG	30	0	38	20	0	0	5	25
CL				260				
				275				205
TD	245	175	218	275	150	385	110	205
=====								
WELL NAME								
REF. EL.	MY09 91	MY10 99	MY11 95	MY12 87	MY13 122	MY16 74	MY17 71	MY18 40
=====								
SYMBOL								
CL	0		0	0	0		0	
SG	39	0	10	10	15	0	10	0
CL					180			
	147TS	180TS		162TS	195TS	145TS	145TS	162TS
TD	147	180	180	162	195	745	145	162

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
 WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
 SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

HELL NAME								
REF. EL.	MY19 25	NY20 47	MY21 48	MY22 61	MY25 43	MY32 10	MY33 49	MY34 69
=====								
SYMBOL								
CL	0	0		0			0	0
A	18	16						
SG				60	0	0	23	19
CL				150				
		210TS	165TS	160TS	110TS		123TS	107TS
TD	228	210	165	160	110	919	123	107

HELL NAME								
REF. EL.	MY35 81	NY36 56	MY37 45	MY40 81	MY41 80	MY42 69	MY43 85	MY44 77
=====								
SYMBOL								
CL			0	0	0	0	0	0
SA								45
SG		0	8	33	46	15	18	
CL			86	135	136	109	131	105
SA			100					125
CL								135
	141TS	97TS	101TS	138TS	145TS	112TS	139TS	147TS
TD	141	97	101	138	145	112	139	147

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SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

WELL NAME								
REF. EL.	MY46 66	MY47 58	MY48 36	MY49 99	MY50 52	MY51 47	MY52 25	MY53 24
SYMBOL								
CL				0				
SG				10				
CL				174				
	145TS	160TS	145TS	176TS	134TS	131TS	275TS	435TS
TD	145	160	145	176	134	131	275	435

WELL NAME								
REF. EL.	MY54 138	MY55 132	MY56 130	MY57 102	MY58 89	MY59 94	MY60 73	MY61 66
SYMBOL								
CL	0	0	0	0	0	0	0	0
HI							25	
							122WOOD	
A							126	
SG	13	12	10	16	21	17		67
		18961						248GY
							191VOID	
	197TS	190TS	181TS	157TS	206TS	182TS	194TS	251TS
TD	199	190	185	159	208	182	194	253

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SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

WELL NAME								
REF. EL.	HY62 27	NY63 55	MY64 59	MY65 28	MY66 86	MY67 50	MY68 49	MY69 10
=====								
SYMBOL								
CL	0	0	0	0	0	0	39	0
						20SHELLS		
SG	18 24961	16 1346Y 135VOID	11	19 1866Y	17	80	52	93
							262VOID	267WOOD
SG								269
	253TS	137TS	142TS	187TS	158TS	217TS	270TS	
TD	255	137	143	187	160	217	270	976

WELL NAME								
REF. EL.	MY70 36	MY71 30	MY72 30	NY73 34	MY74 10	MY75 82	MY76 49	MY77 47
=====								
SYMBOL								
CL						0	0	0
SE						6	40	15
	327TS	414TS	262TS	280TS		169TS	211TS	160TS
TD	327	414	262	280	650	169	211	160

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

HELL NAME								
REF. EL.	MY78 72	MY79 70	NY80 41	MY81 101	MY82 73	MY83 62	MY84 53	MY85 7
SYMBOL								
CL								0
A								16
CL								100
SG								108
	160TS	205TS	235TS	192TS	163TS	204TS	25373	317TS
								300ROCK
								308SHALE
TD	160	205	235	192	163	204	801	328

HELL NAME								
REF. EL.	MY86 15	MY87 25	MY88 15	MY90 53	MY91 75	MY92 65	MY93 48	MY94 76
SYMBOL								
CL			0		0	0	0	
2c	10	18						
A	45	120	90					
SG				0	12	123	6	
CL				88				
	359TS	801TS	305TS	93.5TS	162.5TS	149TS	143TS	197TS
TD	385	806	341	98	183	169	144	197

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.

SANDIA NATIONAL LABORATORIES
WEEKS ISLAND GEOLOGICAL CHARACTERIZATION
SUMMARY OF INTERPRETATIONS FROM DRILLERS' LOGS

HELL NAME								
REF. EL.	MY95 95	MY96 50	MY130 50	MY131 50	MY132 50	MY133 52	MY134 50	MY135 52
=====								
SYMBOL								
S		150	148	149	150	153		
	197TS	152TS	150TS	151TS	152TS	155TS	160TS	145TS
TD	197	172	230	195	177	180	210	165

HELL NAME		
REF. EL.	MY136 50	MY137 52
=====		
SYMBOL		
	149TS	145TS
TD	160	155

REF. EL. IS RELATIVE TO MEAN SEA LEVEL (FT); ALL DEPTHS ARE MEASURED IN FEET BELOW REF. EL.